AVIATION WEEK

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NOV. 10, 1952

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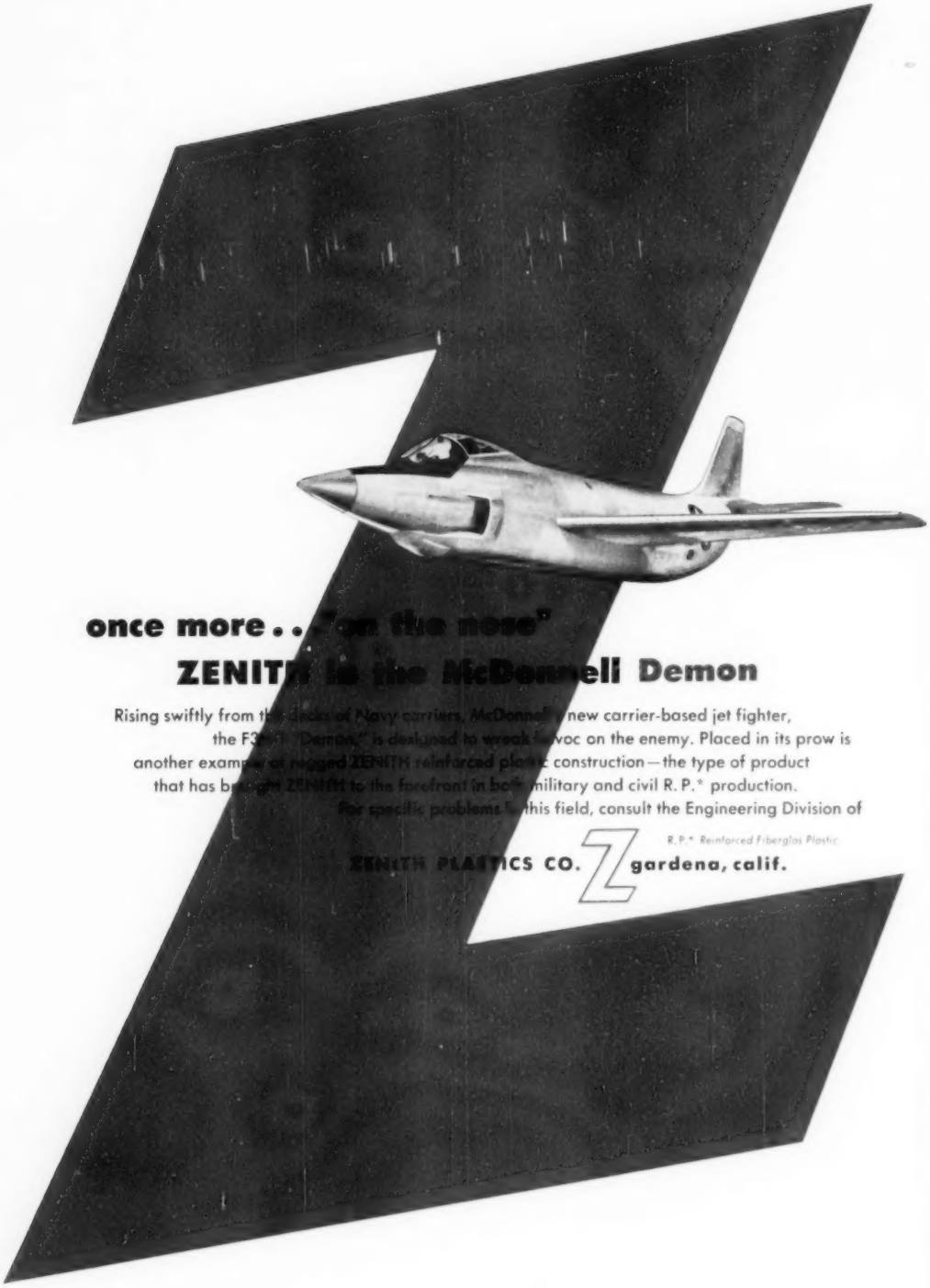

once more . . . "on the nose"

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Rising swiftly from the decks of Navy carriers, McDonnell's new carrier-based jet fighter, the F3H-1 "Demon," is designed to wreak havoc on the enemy. Placed in its prow is another example of rugged ZENITH reinforced plastic construction—the type of product that has brought ZENITH to the forefront in both military and civil R. P.* production. For specific problems in this field, consult the Engineering Division of

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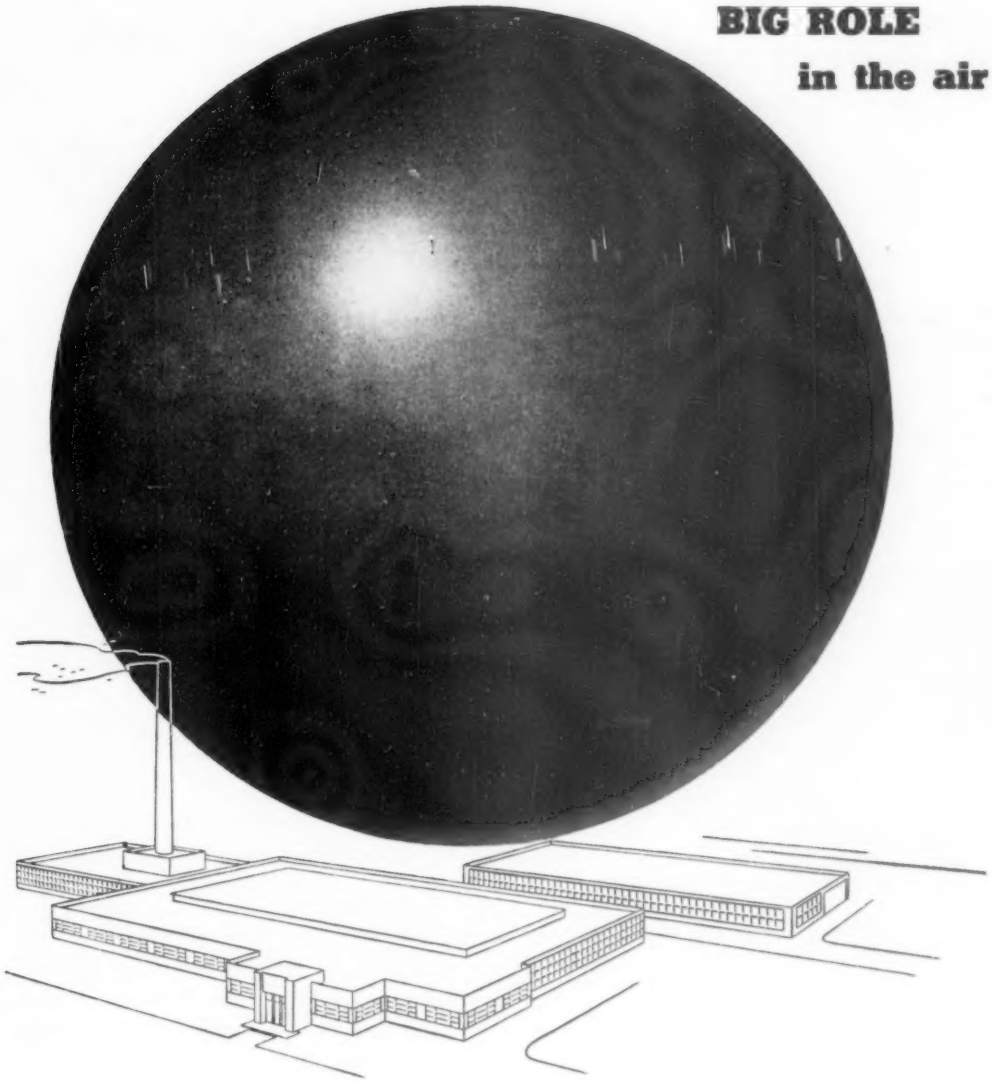

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Aviation Week

ABP Member

Volume 57 **November 10, 1952** **Number 19**

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ROCK-STEADY FORTRESS *on wings!*

New AiResearch Electronic Computer keeps rocket fire "on target" with magical precision

A tiny Elevation Computer in the nose of the F-94 Lockheed *Starfire* makes this new jet in effect a rock-steady platform at the instant its rocket guns are fired.

It was developed by AiResearch as a vital part of the complete Hughes Electronic Fire Control System, which directs the F-94 to the target. The computer continually and automatically calculates the angle of attack by correcting for a half-dozen or more variable aim-influencing factors. They include the burning of fuel, disposal of ammunition, shifting of weight when rockets are fired, dropping of wing fuel tanks, rocket jump, and swift acceleration of the plane itself.

The Elevation Computer is just one of the many types of airborne electronic controls pioneered and manufactured by AiResearch. Today the company produces over 800 electronic units every month.

If you have a problem involving electronic equipment for temperature control, remote positioning, synchronizing, or analogue computers, consult AiResearch now.

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MUSICK MEMORIAL TROPHY

"...most effective in furthering the safety of aircraft..."

The Musick Memorial Trophy, known throughout the world of aviation, is for annual award "to the group, body or individual that has recently made the contribution, development or improvement which by its practical application has become most effective in furthering the safety of aircraft with special reference to transoceanic aviation, or directly so by increasing the efficiency of aircraft."

The Trophy was established in 1938 by citizens of Auckland, New Zealand, in memory of Capt. Edwin C. Musick and his six companions in the "Samoan Clipper" who were lost in the South Pacific on January 12, 1938 while making the first commercial flight from the United States to New Zealand.

For its contribution in furthering the safety of transoceanic aircraft, the Sperry Engine Analyzer has recently won the Musick Memorial Trophy for 1951. This award was made to *John E. Lindberg, Jr.* and *James W. Wheeler* who jointly developed the Analyzer. At the time of this development, Lindberg was a staff engineer in the Pacific-Alaska Division of Pan American World Airways and Wheeler was head of the engine instrument department of the Sperry Gyroscope Company.

Acclaimed for its contributions to flight safety, the Analyzer is in wide use on commercial and military planes throughout the world. It immediately detects, locates and identifies detailed ignition and mechanical troubles in aircraft power plants either during flight or on the ground.

Sperry Gyroscope Company
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Great Neck, New York

NEWS DIGEST

Domestic

Wright Aeronautical division of the Curtiss-Wright Corp. has received a large order for Wright J65 (Sapphire) turbojet engines for a new Navy interceptor plane still on the secret list. This marks the first time the 7,200-lb.-thrust engine has been designated for a Navy plane. The J65 is now in production at Wood-Ridge, N. J., also will be manufactured under license by Buick Motor Car division of General Motors.

North American Aviation has announced that a test model F-86E Sabre, the first one built, recently completed its 500th test flight after two years of strenuous flying. Test pilot George Welch said the plane handled as easily on its 500th flight as on its first.

The Thurman H. Bane Award for 1952 has been presented posthumously to Maj. Patrick L. Kelly of the USAF. The Institute of the Aeronautical Sciences Award for Outstanding Achievement in Aeronautical Development recognized Major Kelly's work on techniques providing for artificial stability and control of aircraft during high-performance phases of operation. Maj. Kelly was killed in an air crash near Dayton in November 1951. The institute gave a similar award to Henry Seeler of Wright Air Development Center's Aeromedical Laboratory for development of a high-altitude respirator.

Continental Air Lines has received the first of seven Convair-Liner 340s from Consolidated Vultee, with the remaining six due for delivery during the first half of 1953.

Hiller Helicopter has presented California State Polytechnic College one of its early models, a UH-4, to be used in courses on aircraft design and construction by the Aeronautical Engineering Department.

Dr. Charles M. Mottley will succeed Dr. S. D. Cornell as director of Planning division of the Department of Defense Research and Development Board, according to an announcement by the chairman of the board. The appointment was to be effective Nov. 3.

The 6580th Missile Test Wing at Holloman Air Force Base, Alamogordo, N. M., has been redesignated as the Holloman Air Development Center. The center will test and carry on research development related to tests on pilotless aircraft, guided missiles and allied equipment, in addition to research and development in space biology; support research programs in guided missiles, electronics, atmospherics, physiology and psychology; and provide facilities for contractors and other agencies to conduct research and development operations.

Pan American World Airways plans to purchase two government buildings for $755,070 at LaGuardia Airport, according to Reconstruction Finance Corp. Over a period of 10 years PAA has paid a total of $944,000 in rentals to the government for the buildings.

Jack Ford, president of Fleetway, Inc., has arrived in Tokyo flying a twin-engine Aero Commander after a 15,000-mi. flight via the North Atlantic, across Europe and then to the Far East. Ford flew the plane to Tokyo for delivery to a Japanese newspaper.

The Boeing XB-52 Stratofortress has been turned over to USAF for a flight test and evaluation program. According to Boeing senior vice president Wellwood Beall, tooling for production is practically completed. Beall said the only change being made from the experimental models was the use of a side-by-side cockpit instead of a tandem seating arrangement.

Financial

Boeing Airplane Co. reports net earnings of $10,167,366 for the three quarters ending Sept. 30. A dividend of $2 per share was declared, payable Nov. 26 to stockholders of record Nov. 6. Unfilled orders on Sept. 30 amounted to about $1,464,000,000, most of it military business.

Trans World Airlines had a profit of $4,270,693, after taxes, in the third quarter of 1952. Total net for first three quarters amounts to $6,228,096. A stock dividend of $\frac{1}{5}$ of a share of common stock for each share of common stock held of record Dec. 15 will be payable Jan. 15, 1953.

Eastern Air Lines has borrowed $10 million from a group of 26 banks, headed by Chase National Bank, to buy new aircraft and other equipment, according to New York Stock Exchange report.

National Airlines has obtained loans of $12 million from three banks for purchase of new aircraft.

Northwest Airlines realized a net profit of $962,634 after taxes at the end of the third quarter of 1952. Net profit for the month of September was $719,273.

Continental Air Lines reported a profit of $129,733 for the third period of 1952. Net income for the first nine months of this year totaled $218,673.

McDonnell Aircraft Corp. had a net profit after taxes of $904,262 for the three months ended Sept. 30. Earnings after taxes for fiscal 1952—$3,064,243.

Westinghouse Electric Corp. earned net income for first nine months of 1952 of $48,741,000. The third quarter net income was reported at $17,233,000.

Electrol, Inc., shows a net profit of $191,621, for six months' period ending Sept. 30. Electrol manufactures aircraft and industrial hydraulic devices.

Aeroquip Corp. has declared an extra dividend of 2½ cents a share payable on Dec. 1 to stockholders of record Nov. 15; this was in addition to the regular dividend of 7½ cents per share payable at same time. Net earnings after taxes were reported in excess of $900,000.

American Brake Shoe Co. reported earnings for nine months ending Sept. 30 of $3,563,566, with earnings for third quarter of $899,202. Production of castings for jet aircraft engines is expected to begin during fourth quarter at new foundry in Median, N. Y.

International

International Air Transport Assn. says world airline traffic broke new records during the summer, according to interline transactions for July and August put through the IATA clearing house in London for settlement. The July turnover amounted to $20,977,000 and August $20,869,000; previous record was $18,885,000 in May, 1952.

The Far East and Pacific Office of the International Civil Aviation Organization will be moved from its present Melbourne, Australia, site to a city on the Asian mainland, probably Bangkok.

Canadian Department of Defense Production issued contracts valued at $2,236,000 for aircraft overhaul, parts and equipment during the first two weeks of October. Largest order, $1.3 million, was to A. V. Roe Canada Ltd., Toronto, for repair and overhaul of aircraft.

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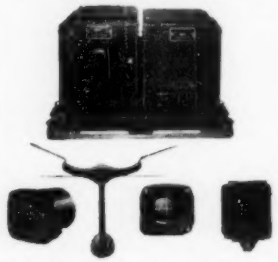

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AVIATION CALENDAR

Nov. 10-11—Eighth annual convention of The Magnesium Assn., Hotel Biltmore, New York.

Nov. 11-12—Piper distributors' annual meeting, Lock Haven, Pa.

Nov. 13-15—Acoustical Society of America symposium on aircraft noise, San Diego, Calif. (For details, write ASA, 57 E. 55 St., New York 22.)

Nov. 17-18—First regular meeting Operations Research Society of America, National Bureau of Standards, Washington, D. C.

Nov. 17-20—National Aviation Trade Assn. annual convention, Hollywood-Roosevelt Hotel, Los Angeles.

Nov. 19-21—Fourth Annual Safety Seminar sponsored by Flight Safety Foundation, Hamilton, Bermuda.

Nov. 30-Dec. 5—Annual meeting of ASME, Hotels Statler and McAlpin, New York, N. Y.

Dec. 1—Fourth annual Air Cargo Day, (ASME), Hotel Statler, New York, N. Y.

Dec. 2—Symposium on light-metal heavy forgings and extrusions for aircraft, SAE, ASME, IAS and AIME, Hotel Statler, New York.

Dec. 2-5—Aviation Distributors and Manufacturers Assn. tenth annual meeting, The Kenilworth, Miami Beach.

Dec. 3-5—Society for Experimental Stress Analysis, annual meeting, Hotel McAlpin, New York.

Dec. 4-6—Sixth annual Arizona Aviation Conference, Douglas, Ariz.

Dec. 17—Annual Wright Bros. dinner, 7:30 p.m., Statler Hotel, Washington, D. C. Wright Bros. lecture to be presented by IAS 3 p.m., U. S. Chamber of Commerce auditorium.

Jan. 12-16—Annual meeting and engineering display of Society of Automotive Engineers, Sheraton-Cadillac Hotel, Detroit.

Jan. 14-16—AIEE-IRE-NBS conference on High Frequency Measurements, Statler Hotel, Washington, D. C.

Jan. 19-23—Plant Maintenance Conference, Public Auditorium, Cleveland, O.

Jan. 19-23—Winter general meeting of the American Institute of Electrical Engineers, Hotel Statler, New York, N. Y.

PICTURE CREDITS

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AW-11-10-52

STARFIRE FIRES AWAY—Enshrouded in smoke and flame, a Lockheed F-94C Starfire (upper center) fires a salvo of 2.75-in. Aeromite rockets during a test over the California desert while a Lockheed T-33A flies nearby taking pictures. Now see below . . .

SMOKE EATER—Although the rockets are well on their way, the Starfire is still flying blind. The all-rocket armed interceptor has considerable avionics equipment for seeking its target and firing its missiles automatically.

Military Aircraft In Action

FLOATING HELIPORT—A Marine Corps Sikorsky HRS-1, airlifting Leathernecks from the Korean coast during a training problem, prepares to land on the escort carrier USS Sicily. Another HRS can be seen on the carrier's stern.

Remington Rand Methods News

The case of the punch press that was not popular

When a well-known manufacturer switched to Remington Rand punched-card costing, the new detailed reports revealed surprising doings in the shop.

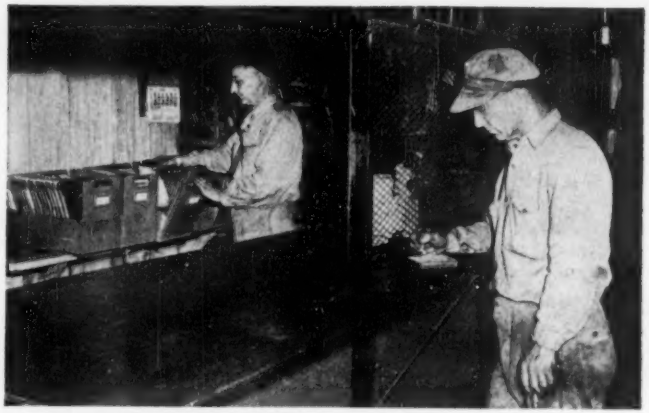
For instance, one report indicated a certain type of punch press was the most efficient on a particular operation. But another report showed the press was not being used on this operation. Investigation revealed that workers preferred a different type of press which was easier to operate. Management now had all the facts needed for effective action.

What's more, this new system put the finger on profit leaks much faster. Instead of waiting 30 days to get sketchy facts, management now gets complete cost reports 5 days after completion of a job.

Naturally, costing is just part of the punched-card accounting operation which helps the firm produce better products at lower cost with better service to customers. Let us show you how it also simplifies materials management, production control and payrolls. Ask for case history folder **SN-752.**

If you'd be interested in punched-card services to get the same informative records without setting up your own punched-card department: folder **BSD-6.**

NEW MANUAL HELPS YOU SLASH PURCHASING PAPERWORK COSTS—Here are 20 pages of practical ideas to save time in the purchasing department; to give buyers complete information for sound purchasing decisions. Case histories show you how others profit by using the illustrated forms, methods and procedures. Covers every phase of paperwork from receipt of requisition to closing of order file. Ask for manual X-1202.



TOOL CRIB UNDER CONTROL. Say goodbye to your old-fashioned tool check-out methods. This simple *visible* method will double-check itself to prevent errors in charging out tools . . . enable each tool center to keep its own records accurately, easily . . . give you tool inventory control as a by-product. Get details from folder KD-641.

How a plant doubled its turnover rate on parts and materials

Within six months after putting in a new materials control program, this plant reduced its parts inventory by a million dollars—and doubled its turnover rate—yet maintained a better cushion against shortages than before.

Because delivery schedules for incoming materials were tied in closely with production schedules, the plant also eliminated unnecessary handling of material and warehousing.

Heart of this system was a Kardex materials control record giving fast *visual* analysis of status of each individual item. Without referring to ledger entries, the clerk could spot any item which threatened to slow production.

Yet, for detailed analysis, this type of record also furnishes a complete and convenient history of each item, including purchases, usage and projected requirements for coming months.

Whether you have 500 or 50,000 parts, you will find this flexible method is invaluable for maintaining the proper balance between the cost of acquiring an item and the cost of possessing it. If you have punched-card production records, this method provides a positive supplement to your control system. For details, see our methods file **MC-767,** available on loan for your study.

QUICK RELIEF FOR COMMON HEADACHE IN PRODUCTION

A small part can cause a big headache—when it's the wrong part. Poor description of parts causes all kinds of trouble: production delays, duplicate stocks and high paperwork costs. But the cure is simple. Identify and classify each item properly, so it can be referred to by exact number. The cost is less than you may think. Our engineers have built up a special library of standard nomenclature and numbering systems which can be readily adapted to your parts and materials. For more details, see our booklet **BSD-10.**

Remington Rand

Management Controls Reference Library
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WHO'S WHERE

In the Front Office

Solomon R. Baker has been named president of Pyrene Mfg. Co., fire-fighting equipment firm of Newark, N. J. Pyro, Inc., of which Baker is president, recently purchased a majority stock in Pyrene.

Changes

Val Cronstedt has been appointed director of engineering for the Gas Turbine division of A. V. Roe Canada, Malton, Ontario. He formerly was with Pratt & Whitney Aircraft.

F. A. Smith has been designated B-47 project engineer at Lockheed Aircraft Corp., Georgia division, Marietta.

M. R. Sturdivant has been named general superintendent of aircraft fabrication and machining for Kaiser-Frazer Corp., Willow Run, Mich., to handle detail parts for the C-119 and C-123.

Edwin J. Rudisuhle has joined Lenkurt Electric Co., San Carlos, Calif., to handle sales engineering of application of carrier channelizing equipment to VHF and microwave radio links.

William O. Murray has been appointed industrial sales engineer for Parker Appliance Co. with headquarters in Pittsburgh.

Robert O'Skea has been named international traffic and sales coordinator for Philippine Air Lines, with headquarters in Manila.

John Muchmore has joined AiResearch Mfg. Co., Los Angeles, as staff assistant in public and industrial relations.

Lawrence B. Kinports has been named general manager of Northwest Airlines' Orient Region, replacing **D. J. King**, who is returning to the U. S. for re-assignment.

Ralph Floyd, former assistant sales manager for Cessna Aircraft Co., Wichita, Kans., has become a partner in Sunny South Aircraft Sales, Inc., Ft. Lauderdale International Airport, Fla.

Dr. Max Kramer, German wartime guided missile scientist, has joined the engineering staff of Coleman Engineering Co., Los Angeles.

Dr. Thomas E. Roberts has joined Norden Laboratories Corp., Milford, Conn., as senior research engineer.

Honors and Elections

Col. Andres Soriano, president of Philippine Airlines, has been given the National Safety Council's Award of Merit for the carrier's mark of 1,071,000 manhours without a lost-time injury from Mar. 27 to June 30.

Brig. Gen. John P. Henebry has been elected president of the Air Reserve Assn. of the U. S. **Col. A. B. McMullen** has been re-elected executive director.

Melvin H. Snyder, head of the Aeronautical Engineering Department of the University of Wichita, has been named chairman of the Wichita Section of the National Institute of the Aeronautical Sciences.

INDUSTRY OBSERVER

► Aircraft workers with cost-of-living escalation clauses in their wage contracts can expect a reduction of up to two cents an hour when the next cost of living index is published at the end of November for Dec. 1 wage adjustments. The cost of living index has already slipped one point during the past two months with indications strong for a continuing downward trend during November.

► Employment in the aircraft industry hit a post-war high—718,000 people working in 205 aircraft, engine and component factories by the beginning of September. Increase during June and August was at a rate of 5%. Department of Labor forecasts another 7.5% increase by next February.

► Marine Corps is extremely interested in using the Chance Vought F7U-3 Cutlass as a ground support plane. Rugged construction of the Cutlass makes it less vulnerable to small arms ground fire and it can carry a heavy external load of bombs, napalm and rockets.

► North American Aviation has run successful operational tests with its new avionic device touchdown rate of descent indicator (TRODI) with the FJ-2 Navy version of the Sabre on the carrier Midway. The device measures the rate of descent optically with an accuracy of 0.4 ft./sec. so that data is available for the pilot as soon as he lands and gives him an immediate check to correct rate of descent for future landings if necessary. Earlier camera systems for measuring the rate of descent did not supply immediate data.

► First operational test of the new hydraulic by-pass valve to prevent inadvertent propeller reversing now being developed experimentally by the Hamilton Standard division of United Aircraft Corp., is expected to be made with one propeller governor on an American Airlines' DC-6.

► Hiller Helicopters recently delivered two UH-12B helicopters to the Swiss army for observation, rescue and liaison missions.

► Venezuelan air force has taken delivery at Wichita of three photographic plane modifications of the Twin Beech Model D18S and will ferry them 3,000 mi. to Venezuela. The planes are described as improved versions of the Beech F-2 photo planes used by the AAF in World War II. They will be added to a fleet of nine other Twin Beeches now used by the Venezuelan air force.

► Flight Refueling, Inc., says insurance underwriters have already indicated that if a flight-refueled transport plane service was operated over the North Atlantic, premiums would be lower than those for services which had to make fueling stops. In-flight refueling would eliminate two of three takeoffs and landings otherwise required with accompanying normal hazards of these operations. Using the higher rate of fuel flow of 600 gal./min. now possible in the probe-drogue refueling system which Flight Refueling, Inc., sponsors, it is claimed that a complete operation of refueling a Comet jet airliner could be completed in less than four minutes. Commercial refueling would probably be reversed from military procedure with the airliner trailing the hose and the tanker coming up from behind to make the contact.

► Bendix Aviation has delivered its first production line jet-engine combustion self-starter, a 75-lb. airborne unit which develops 340 hp., to the Buick division of General Motors Corp., at Flint, Mich., for installation with a Sapphire J65 jet engine as powerplant for the Republic F-84F fighter.

► National Bureau of Standards has developed a limit load gage to determine whether basic structural components of planes have been stressed beyond safe limits and suffered permanent damage. Gages have been extensively flight tested on Grumman F8F twin piston-engine Marine night fighters, and on McDonnell twin-jet Banshee fighters.

Washington Roundup

Air Force Outlook

Air Force budgets will take a downward turn starting next year, reaching a level-off rate by mid-1955 when the buildup to a 143-wing-force has been achieved. It will then be a matter of keeping the force modern. But unless the 143-wing program is thrown overboard, USAF budgets after mid-1955 will be around 2.5 times pre-Korea budgets.

Secretary for Air Thomas Finletter gives AVIATION WEEK this picture:

• USAF's budget for the 1954 fiscal year which starts next July, now under consideration at the Bureau of the Budget, will drop several billion dollars from the current 1953 fiscal budget of $20 billion. (From a pre-Korea budget for the 1950 fiscal year of $6.2 billion, USAF's budgets climbed to $16.6 billion for the 1951 fiscal year and reached $22.7 billion for the 1952 fiscal year).

Thomas K. Finletter

• USAF's budget will taper down to $16 billion for the 1955 fiscal year which starts mid-1955, the target for achievement of 143 wings.

• Then USAF budgets will level off to a rate of around $15 billion annually.

• But these estimates are based on the assumption that no more demands will be made on the Air Force, now limited to three missions: strategic air, air support in Europe, and air defense in the U.S. Under this program, the USAF cannot be expected to deploy forces to other parts of the world.

▶ **Maintenance Up, Procurement Down**—USAF's maintenance costs will continue to mount over the next three years, taking a larger slice of its budgets as the 143 wings gradually come into being.

The lowered budgets mean less orders for capital goods.

Money will flow into the aviation industry at an increasing rate up to mid-1955, however, and remain at almost that high level for another year as planes ordered since the USAF buildup started in mid-1950 are delivered.

Finletter reports:

• Money for aircraft and related procurement in the 1954 fiscal year budget will drop to "substantially below $10 billion." (This year it is at a peak of $12.6 billion, climbing from $8.1 billion in 1951 fiscal year to $11.8 billion for 1952.)

• By mid-1955, the requirement for procurement money to support 143 wings may level off at around $6 billion annually. (This will be many times the pre-Korea rate of $1.5 billion for 1950 fiscal year).

▶ **More Guided Missiles**—Guided missiles, however, will buck the downward trend in procurement.

Procurement money for missiles jumped from $12 million in 1950 fiscal year to $149 million in 1951; to $130 million in 1952; to $300 million for the current 1953 fiscal year.

Finletter's comment: "We hope to keep accelerating the program at this rate. We want it to move forward as fast as possible."

His "educated guess" is that by 1960 USAF will be splitting its procurement money 50-50 between piloted planes and guided missiles.

▶ **Back to Intercontinental Bombing**—Congress' enthusiasm for USAF seems to go up and down with USAF's intercontinental bombing capability—the strategy that seems to have most political appeal.

It reached a high point during the regime of former Secretary for Air Stuart Symington when USAF offered the prospect of a B-36 force taking off for a knockout blow on Russia. Economizing Congresses insisted on giving USAF more money for such a force than President Truman wanted.

But congressional enthusiasm dwindled as USAF shifted emphasis to tactical air for the European Theater and medium-range bombers, and launched a large-scale program of overseas bases.

Now USAF is on the road back to intercontinental bombing. Finletter reports:

• The Air Force's intercontinental bombing capability, while still less than we would like it, is constantly improving.

• Refueling of medium bombers, now coming off the production lines at a good rate, is the key to USAF's new capability.

• Even with this capability, though, USAF's overseas base structure will be "useful"—for a variety of approaches to enemy targets and landings for damaged aircraft.

▶ **No Surplus Planes**—USAF won't be selling or disposing of surplus planes in the forseeable future, according to Finletter.

It will be a problem of adapting obsolescent planes to other uses. He reports:

• After it is phased out as a bomber, the B-36 still will be a useful plane for a long time to come as a transport and tanker.

• When fighters come out of the front-line units they will retain a great deal of usefulness. They can be used in our fighter pilot training schools, reserve units and National Guard in a planned program to keep them in an advanced state of proficiency and training.

▶ **Jet Airlift**—Jet transports for rapid troop deployment aren't yet in the Air Force program.

"They are not in our pocketbook," Finletter reports, but adds: "The Air Force, expecially MATS, has this whole problem of jet transport development and procurement under study."

Watchdog Over Aro, Inc.

General Accounting Office is carefully scrutinizing all Air Force payments to Aro, Inc. In particular, GAO reports, it questions:

• High costs in Aro's training program.

• Aro's relation with Sverdrup and Parcel.

—Katherine Johnsen

AVIATION WEEK VOL. 57, NO. 19 NOVEMBER 10, 1952

PAA Comet Certification Battle Looms

- **Acceptance of British standards to be sought.**
- **But CAA hasn't set jet carrier requirements.**

A showdown on Anglo-American differences over airworthiness standards for commercial jet transports is looming as a result of the recent Pan American Airways purchase of three de Havilland Comets.

The Pan American purchase contract is reported to contain a clause making the Comet sale contingent on the British government's ability to get U. S. agreement to accept British airworthiness certification of the Comet 3 (AVIATION WEEK Oct. 20, p. 13).

In London, Robert Hardingham, secretary of the British Air Registration Board, told AVIATION WEEK Pan American desires this assurance during 1953. The Comet 3 prototype is scheduled to make its first flight in 1954.

▶**British Invitation**—Hardingham said he had written to the U. S. Civil Aeronautics Administration inviting CAA investigators to England to study British certification procedures on the Comet 1 and 2. BOAC was reported willing to loan the Comets necessary for this CAA work.

In Washington, CAA Administrator Charles Horne told AVIATION WEEK he had not yet received this British invitation. Acceptance hinged on how much of the operation CAA would have to finance. If it could be handled within current CAA budget limitations, Horne said he felt the venture would be worthwhile and would provide pertinent data in helping to establish U. S. jet airworthiness requirements.

Current CAA policy is that no jet transport can be given a U. S. airworthiness certificate until after it has successfully passed flight tests prescribed by CAA. However, CAA has not yet formulated its operational safety standards for commercial jet transports and feels that considerably more test data, particularly on axial-flow jet engines, is required before this can be done adequately.

▶**Need Agreement**—If CAA and the British Air Registration Board can agree on a mutually satisfactory flight test procedure for jet transports, CAA would be willing to accept British certification that a British transport had met these requirements. However, CAA is not now willing to concur with present British jet airworthiness standards and automatically accept them for U. S. flag airline operations.

London sources expect the British to press for a reciprocity agreement that will force CAA to accept British airworthiness requirements for jet transports and insure any airline that buys transports certificated in Britain automatic operation rights under the U. S. flag.

Underlying the present situation is an interchange of diplomatic notes between the United States and Britain about a year ago. The British requested an American policy of reciprocal certification of jet transports. The U. S. State Department replied the U. S. would be glad to consider the subject and requested information on British procedures with the Comet 1, only jet transport that has been certificated. CAA says it has not yet received any information from the British on this subject.

▶**U. S. Opposition**—U. S. aircraft manufacturers who are interested in jet transport projects strongly oppose any U. S. acceptance of British airworthiness requirements on jet transports that do not conform to whatever CAA requirements are established. They were extremely unhappy over the unfortunate wording of the recent speech by DeWitt Ramsey, Aircraft Industries Assn. president, calling for reciprocal Anglo-American agreements on jet transport certification without requiring conformity between U. S. and British safety standards.

Meanwhile, CAA can be expected to renew its efforts to obtain additional funds for operational testing of jet transports to provide additional data to assist in formulating airworthiness requirements.

Last year's program which was lost in a House-Senate conference included flight testing of the Canadian Avro Jetliner. Possibly, if funds are obtained from the 83rd Congress next year, testing of the Comet 3 might be included in the program to help Pan American get its U. S. airworthiness certificate without which it cannot fly Comet passengers under the U. S. flag.

Boeing Jet to Seat 80-120

Seattle—Production of an 80-120 passenger jet transport will be started by Boeing Airplane Co. in 1956 and the following year should see the plane being turned out in volume, a top Boeing official told an AVIATION WEEK reporter during a recent press conference.

These plans are based on civil and military acceptance of the prototype, which will be ready for demonstration in 1954, according to the company. It will be adaptable to three uses: military and civil transport and as a tanker.

The new Boeing jet will bear no relation in "design or size" to the B-47 or B-52, senior vice president Wellwood Beall told reporters, but will benefit from their development. It will be designed to cross the U. S. with only one stop and its speed will be slightly less than that of the 600-mph.-plus B-47 medium bomber, according to Beall. Cost: $2.5-$4 million.

▶**England Not Ahead**—Beall denied Britain was out in front in the transport field. "We've built and flown more multi-jet airplanes than the British," he declared.

The problem involved was finding private funds for commercial jet transport development, he asserted. The DH Comet, he said, was more or less subsidized—BOAC, for instance, is owned 100% by the British government.

Boeing, is now working on a jet transport because its B-47 and B-52 contracts will give it a tax profit situation making possible investment in the project, he said.

PAA Making Plans For Coach to Hawaii

Balked by CAB orders against trans-Pacific aircoach service before spring, Pan American World Airways has moved to start coach part way across the Pacific next month. PanAm hopes CAB will reconsider its order before long.

Pan American plans to start San Francisco-Honolulu aircoach service in 81-passenger Stratocruisers Dec. 3.

The Pacific question came up when CAB recently handed its secret instructions to U. S. carriers going to a cartel-

fare-setting conference of the International Air Transport Assn. Said the CAB instructions: "On the basis of available data, the Board sees no economic operational basis for trans-Pacific tourist service at this time." The Board added that it would not approve an IATA agreement for such a service except upon a full showing of its economic feasibility. So Pan American has immediately set about coach operation to Honolulu as the first step toward making that "full showing."

▶**PAA View**—The Pan American theory repeatedly stated by president Juan Trippe is that coach economics will improve revenues and serve more of the public. This theory comes down to mathematics and economics indicating that a 33% increase in passenger seating capacity justifies a 25% reduction in fare per passenger—wherever demand is "elastic" (i.e. sensitive to price). PAA's new Stratocruiser coach proposal works out to that percentage exactly—increase Stratocruiser seating from 61 to 81 and reduce the roundtrip fare to Honolulu from $303 to $225.

If it works, and it has for nonskeds plying the same route, Pan American hopes to make the "full showing" requested by CAB as a condition for approval of coach fares all the way to Tokyo. Pan American figures that even this $78 fare concession will stimulate more West Coast Tokyo travel as well as vacation travel to the Hawaiian Islands.

A United Air Lines spokesman said it is unlikely that United will follow PanAm's lead soon, because load factors are running high on the standard service.

CAA Mapping New Private Flying Plan

Behind the scenes at Civil Aeronautics Administration a plan for nationwide promotion of new interest in personal flying, coupled with arousing new zest in American youth for flight training, is taking form.

CAA Administrator Charles F. Horne tipped his hand on the new program last month in a talk at Great Falls, Mont., when he called for cooperation of the whole aviation industry in such a promotional campaign.

An outline of the plan is being circulated around CAA for staff comments and revisions, before it goes farther. But here is what Horne proposed in his speech:

A campaign using all the media and methods of promotion especially institutional advertising, in an effort to revive in young American men and women the attraction which flying used to have for them but seems largely to have been lost.

Aviation Safety

CAB Lauds Crew in Liner Crash

Good judgment saved 49 persons in Braniff accident, Board finds; safety lags cited in another crash.

By Alexander McSurely

Prompt emergency action of an efficient flight crew which enabled 49 persons to escape from an in-flight transport plane fire with only one minor injury is described in Civil Aeronautics Board's Accident Investigation Report just released of a Braniff Airways DC-4 accident near Hugoton, Kan.

Another newly published CAB Accident Investigation Report tells the story of a mid-air collision between two DC-4s whose pilots were practicing instrument approaches at the Oakland, Calif., low frequency range. These planes were operated by California Eastern and Overseas National Airways.

The Braniff plane was en route from Denver to Dallas, Mar. 26, and was about 3,000 ft. above the ground, near Hugoton, when one of the hostesses saw flames on the right wing. Fire-detection devices had not functioned and the engines appeared to be operating normally, at this point.

▶**Decision to Land**—Capt. J. W. Stanford saw the fire reflection on the inboard surface of No. 4 engine nacelle, and he and First Officer J. P. Beakley decided the fire was in the No. 3 engine. Stanford ordered an emergency landing at the small Hugoton Airport and dived the airplane in an attempt to extinguish the fire. He also pulled the No. 3 engine fire extinguisher control.

The fire detection system started the light and warning bell in the cockpit, about the time the landing gear was lowered.

A series of steep, slipping "S" turns was made to get the airplane down. About 200 ft. above the ground a buffeting was noted and it is believed the No. 3 engine fell from the airplane at this point.

With full flaps applied, the plane touched down in the middle of the small airport. Brake pressure was applied but the airplane continued without slowing. The nose steering wheel was "inoperative." Pilot Stanford pulled back the control wheel lifting the nosewheel and the plane rolled off the airport over a highway, through two fences and a ditch and stopped in a wheat field, without using emergency brakes.

Forty-five passengers and the crew of four were evacuated "in an orderly manner"; most of them went through forward and main doors, using descent ropes, and some from an emergency exit over the left wing. Only one minor injury was reported.

▶**Good Judgment**—Analysis by CAB credits Stanford with good judgment in two important decisions. When the co-pilot asked if he should feather No. 3 propeller, the decision was "No." CAB analysis points out that "had the oil line to the feathering mechanism been weakened or burned through by the fire, an attempt to feather No. 3 propeller would have spraved hot oil throughout Zone 2 of the nacelle, greatly intensifying the fire."

His other important decision was in not using the emergency air brakes, because it would have forced the nosewheel to the ground at high speed, with the possibility of serious damage from striking an obstruction.

CAB finding was that the pilot made a safe landing at a small airport unsuitable for DC-4 planes, that the fire detection system did not function properly and that the probable cause of the accident was an uncontrollable fire of unknown origin. Examination of the No. 3 engine fire-detection system did not show incorrect wiring or other apparent cause for its failure to function.

The fire was confined to No. 3 nacelle and the adjacent wing area when the plane stopped, but gained impetus and destroyed a large part of the airplane, including most of the fuselage.

▶**Training Collision**—Two pilots, flying six-month instrument checks under left-side hoods flew their DC-4 airplanes into each other, in simultaneous instrument approaches at Oakland, Nov. 17, 1951. Three captains in the Overseas National DC-4 were killed, and the airplane destroyed by impact and fire. The two captains and mechanic in the Cal Eastern plane were not hurt but their plane was substantially damaged.

CAB finding was that the probable cause was the failure of the Overseas safety pilot and/or his observer to see and avoid the other plane, and the failure of California's safety pilot to have a qualified observer aboard.

Ground observers said the planes converged at an angle of approximately 49 deg., with the Overseas plane a few feet higher than the California Eastern plane, at about 3,000-ft. altitude almost directly over the Oakland range station.

The California Eastern plane's vertical stabilizer leading edge struck the Overseas fuselage just forward of its

horizontal stabilizer, and cut off the entire empennage which fell free from the rest of the airplane. The Overseas plane fell out of control.

Although the tops of the California Eastern plane's vertical stabilizer and rudder were torn off, the plane remained under control, and the safety pilot, Capt. Ralph A. Shope, chief company pilot, made a successful emergency landing soon after at San Francisco Airport, 12 mi. away.

Board analysis is that the Overseas check pilot may have been going through a cockpit check or grading the other pilot or for some other reason failed to see the converging plane. The mechanic, working in the California cabin, observed the other plane, but it was then too late to warn before the collision.

"Both aircraft could have been plainly visible, one from the other, had safety requirements of adequate lookout from both aircraft been adhered to," the CAB analysis finds.

Airlines Set Plans For M-Day Fleet

The airlines have finally agreed on how many planes each should assign to the Air Force in the initial stage of wartime mobilization. But the quarrel goes on over how they shall divide up the majority of planes—those that stay on commercial operation.

TWA will contribute the most planes to the so-called civil air reserve fleet—37 Constellations and 11 DC-4s. Nonskeds will contribute 13 DC-4s altogether.

Other participation now agreed: Alaska Airlines 2 DC-4; American 14 DC-4, 7 DC-6, 3 DC-6A, and 18 DC-6B; Arabian American Oil Co. 1 DC-4 and 2 DC-6B; Braniff 4 DC-4 and 5 DC-6; Capital 2 DC-4 and 10 Constellations; Chicago & Southern 3 Constellations; Delta 5 DC-4; Eastern 11 DC-4 and 18 Constellations; Flying Tiger Line 2 DC-4 and 5 DC-6A; National 6 DC-4 and 4 DC-6B; Northwest 6 DC-4 and 3 B-377; Pacific Northern 1 DC-4; Panagra 4 DC-4 and 1 DC-6B; Pan American 19 DC-4 and 15 B-377; Slick Airways 5 DC-6A; Trans Caribbean 3 DC-4; United 5 DC-4, 11 DC-6, 19 DC-6B and 6 B-377; and Western 5 DC-6B.

Negotiations settling on this were spurred by Commerce Department's Defense Air Transportation Administration under Ray Ireland, who returned to full-time duty at United Air Lines after completing this job.

Next steps are:

• **Modifying** the fleet reserve planes for 48-hr. mobilization readiness to fly overseas. Modification is by Air Materiel Command contract. Only direct loss for the airlines is in carrying the average 50 lb. of extra equipment in commercial operation.

• **Dividing up** the planes left behind. Those contributing more than their share abroad must lease planes from others at home. Civil Aeronautics Board is the arbiter on how many each may lease from whom and at what price. The Air Force, of course, cannot know exactly how many airliners it may need in a mobilization. That depends on where and what type of war breaks out. The 294 earmarked for readiness for long-range operation are the basic airlift reserve fleet. Shorter-range planes could also be operated overseas on routes other than the long San Francisco-Honolulu hop.

Air Industry Use Of Titanium Booms

Expansion of titanium use in U. S. airframe manufacturing and design and in guided missile development continues moving far ahead of the infant metal industry's ability to supply demands.

Newest spark plug to ignite the aircraft industry's interest in titanium's unusual capabilities was the recent speech by Brig. Gen. Kern D. Metzger, chief of Air Materiel Command's Production and Resources Division, at a San Diego meeting of the Institute of the Aeronautical Sciences, attended by a large group of West Coast aircraft technical men.

Following up Metzger's request that industry and the military services "working together solve the many problems that must be overcome before titanium can be used in quantity," is an AMC survey, now underway, to determine what U. S. military aircraft contractors are doing and planning in present and future aircraft and missile designs.

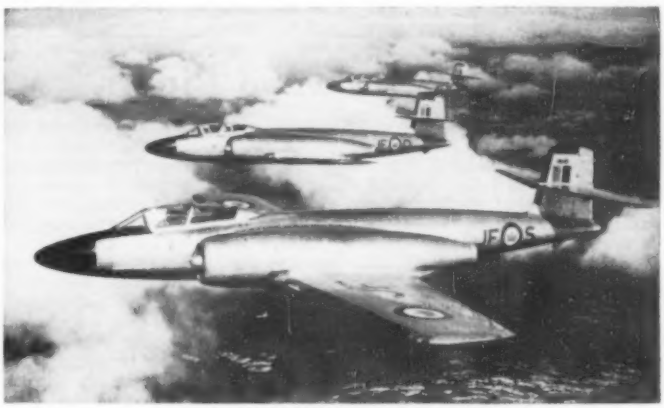
Meanwhile, Defense Production Administration last week announced plans to step up national titanium output to at least 22,000 tons a year by 1956, or "as far in five years as aluminum went in its first 50 years." Earlier plans had called for expansion from present capacity of 2,000 tons a year to 10,000 tons by 1955.

DPA stepup was still short of what the Munitions Board had asked: 35,000 tons a year by 1956 with 95% of the metal for aircraft. This would have required $140 million for new plants and about $525 million for the metal, DPA said.

DPA does not want to get that deeply involved in the costly Kroll sponge-process for making titanium, the only process now being used in production. Industry feels it will be just a matter of time before a better production process is developed and some 40 U. S. companies are reported doing research in this direction. One company alone reportedly has five different processes in pilot-plant operation.

Besides financing arrangements for Titanium Metals Corp. and Du Pont, previously noted in AVIATION WEEK, Defense Materials Procurement Agency is negotiating with at least two other potential producers for similar agreements.

Advantages of titanium's high strength-to-weight ratio and details of its properties and airframe structural uses were reported in AVIATION WEEK July 14, pp. 13-14.



AVRO CANADA FIGHTER TRIO

Three Avro Canada CF-100 Canucks in formation during a training flight from their base at North Bay, Ont. Here crews are being familiarized in the operation of the big twin-jet all-weather fighters now in large-scale production for the RCAF. The CF-100 is powered by Avro Canada-designed and built Orenda jet engines rated at over 6,000 lb. thrust each. The plane is equipped with radar.

NEW TRI-PACER—Piper will try to sell 50% more of these in 1953.

1953 Piper Pacer and Tri-Pacer

Specifications

	Pacer PA-20	Tri-Pacer PA-22
Powerplant	Lycoming 0-290-D2	Lycoming 0-290-D2
Power and rpm	135 @ 2,600	135 @ 2,600
Gross weight, lb.	1,950	1,950
Empty weight, lb.	1,005	1,040
Span, ft.	29.3	29.3
Length, ft.	20.4	20.4
Height, in.	74.5	100
Baggage cap., lb.	100	100
Fuel cap., gal.	36	36
Top speed, mph.	139	137
Cruise speed, SL	125	123
Stall speed, flaps	48	48
Climb, fpm.	800	800
Cruise range, mi.	580	580
Service ceiling, ft.	15,000	15,000
Fuel cons., 75% power, gal./hr.	7.7	7.7

Prices		
Standard	$5,395	$5,595
Custom	6,065	6,195
Super Custom	6,975	7,105

Distributors See 1953 Pipers

Piper Aircraft Corp. distributors will gather at Lock Haven, Pa., for their annual meeting Nov. 11 and 12 to map the 1953 sales campaign. After it is over they will take with them approximately 60 new Pacer and Tri-Pacer demonstrators to show the customers at home.

Of particular interest to distributors and customers alike is Piper's decision to hold the line on prices (see accompanying table). The company's hottest competitor, Cessna, reportedly has gone up approximately $1,200 on the 170-type to a price about $3,000 above that for which Piper dealers can sell an airplane.

▶ **Sales**—In the fiscal year ending Sept. 30, Piper sold 1,059 planes to civilians, broken down thus: 465 PA-22 Tri-Pacers, 143 PA-20 Pacers, 258 PA-18 and 193 PA-18-A Super Cubs, plus several hundred military versions of the Super Cub.

In fiscal 1953, Piper's production goal is 1,400 civil planes. It expects to double PA-18-A agricultural plane output and is aiming to increase Tri-Pacer sales by 50% over last year.

The new models retain the previous year's general configuration but numerous refinements have been incorporated, notably larger cabin area, lower sound level inside and instrument panel designed to take the large variety of navigational aids becoming popular, especially among business owners.

▶ **Larger Interior**—There's 18% more usable area in the 1953 Pacer and Tri-Pacer cabins, making possible more than 40 in. of shoulder width in the front seats and nearly that much in the rear.

Modification of the welded steel tubing structure behind the cabin has permitted doubling baggage area from 6 cu. ft. to 12.5 cu. ft. and weight allowance increase 100% to 100 lb. By unsnapping a hat shelf behind the rear seats, baggage capacity goes up to 16 cu. ft. And further, by removing the rear seats, the plane's cargo capacity becomes 42 cu. ft.

▶ **Noise Reduction**—Installation of a large stainless steel exhaust muffler and use of a heavy Fiberglas envelope around the cabin, with double thickness on the firewall and engine cowling, have sharply reduced engine noises. Sections of the fuselage near the engine have been sprayed with automobile-type sound-absorbing material and a quilted pad has been fitted forward of the instrument panel to cut resonance.

By using a heavy gage Plexiglas and sealing the side windows Piper engineers have succeeded in further reducing the noise level.

▶ **New Panel**—A variety of instrument installations are possible with installation of a basic sub-panel having pre-cut holes for gyro devices and a dozen other instruments. Also, the owner can get several optional face plates to handle various combinations. The "pre-fabricated" sub-panel saves the expense of cutting up the board for installation of additional instruments after the plane has been purchased.

Maintenance is facilitated by having a large removable panel in the belly permitting easy access to stabilizer mechanism, radio loop and controls.

UAW Asks Probe Of Aircraft Wages

A government investigation of wages and collective bargaining in the aircraft industry is being requested by the UAW-CIO to back up wage demands the union plans to make on the industry in 1953.

This was decided recently at a three-day UAW-CIO national aircraft conference in Chicago. Representatives of UAW-CIO aircraft locals, claiming to represent almost half the country's 440,000 aircraft workers, participated. They also heard talks by Air Force Undersecretary Roswell L. Gilpatric and John Floberg, Assistant Secretary of Navy for Air.

UAW-CIO wants a "government commission" set up to "study" union charges that aircraft management is taking advantage of workers by paying low wages and treating employes unfairly while obtaining benefits for itself from the government. UAW-CIO sources were not sure just who would set up such a commission. The suggestion will be made to Congress and to Air Force Secretary Thomas K. Finletter.

UAW-CIO maintains that there is a wage differential of more than 20 cents an hour between the aircraft and automobile industries which it wants corrected. Other major demands the union included in its "economic program" for next year:

- **Automatic progression,** within a rate range, of five cents an hour every 30 days.
- **Cost-of-living** escalation.
- **Annual productivity** increase.
- **Severance pay** of $150 for every year employed, up to $1,500.
- **Employer-paid health insurance** covering hospitalization and in-hospital expenses for a worker and his family, disability pay of 60% of wages and life insurance of one year's wages.
- **More liberal vacation** and sick-leave plan.
- **Eight paid holidays** a year.

The conference also "resolved" to: (1) Try to get the $1.05 Walsh-Healey Act minimum wage on government contracts in aircraft raised to $1.50; (2) promote "intra-corporate" aircraft committees for the purpose of exchanging information on union demands and company policies; (3) intensify the organization of office workers and engineering and technical personnel.

USAF Speeds Up Contract Letting

Air Force is letting contracts for aircraft and related procurement at a high rate, but Navy is lagging.

For the first quarter of the current 1953 fiscal year—July, August, September—Defense Department's Office of the Comptroller reports:

- **USAF obligated** $4,967.5 million. USAF had a total of $12 billion to obligate for the year: $11 billion in new contractural authority and $1 billion carried over from previous budgets. For the first quarter of the 1952 fiscal year, USAF obligated $3,508.9 million.
- **Navy obligated** $740 million. This was substantially below obligations during the first quarter of 1952 fiscal year which totaled $1,386.5 million. Navy has $3.5 billion to obligate this year: $3.45 billion in new obligational authority and a $51.5-million carryover from earlier budgets.

A spokesman for Bureau of Aeronautics said that personnel limitations on Washington employment, where its procurement activities are centered, is the main reason for the lag. BuAer hopes to regain ground and be on schedule by the first of the year.

Expenditures, or actual payments, for aircraft and related procurement of both the services are up sharply over last year.

For the first quarter of fiscal 1953, the Defense Comptroller's Office reports:

- **USAF payments** totaled $1,275.8 million. This compares with expenditures of $742.7 million during the first quarter of 1952 fiscal year.
- **Navy paid out** $351.3 million. This compares with expenditures of $242.9 million for the first quarter of 1952 fiscal year.

Airport Construction: A Progress Report

(Figures in millions of dollars)

	1947	1948	1949	1950	1951	1952	Fiscal Year 1953	Totals
Congress appropriated for new airport construction..	$42.7	$30.7	$37.0	$36.5	$21.0	$15.8	$11.7	$195.5
Civil Aeronautics Administration made grants totaling..	$ 3.0	$25.5	$49.9	$44.0	$39.7	$19.5		$181.7
(1) For small Class, I, II, III airports.....	3.0	12.0	13.0	7.7	6.7	3.4		$ 45.9
(2) For large commercial airports		13.5	36.8	36.4	33.0	16.1		$135.8

Local Airports Await U. S. Funds

Local communities are ready to finance their share of a $300-million airport development program, but are marking time because there are no federal matching funds.

Civil Aeronautics Administration estimates that localities and states have already authorized $75 to $80 million for airports and would be prepared to put up a total of $150 million if they could obtain matching funds. Under the 1946 Airport Act, the federal government is authorized to pay approximately 50% of the cost of projects. Localities balk at financing the total cost of projects when there is the prospect of federal assistance being given to them.

The story of the airport program is similar to that of most civil public works programs.

Although it showed early enthusiasm in 1947 and 1948, Congress each year has cut down appropriations in its economy efforts. From a $42.7-million appropriation in 1947 fiscal year, airport construction allocations have dwindled to a low of $11.7 million for the current fiscal year.

▶ **Small Airports Hit**—Under the policy since the Korean war of concentrating on airport developments important to national defense, small airport projects have been hardest hit. In the 1948 fiscal year CAA made grants of $12 million for small Class I, II, and III projects. In the 1952 fiscal year grants added up to only $3 million. The tremendous expansion of corporation aircraft, CAA reports, has accented the deficiency in small fields.

The airport program is lagging behind on its time schedule. For seven years, from the 1947 fiscal year through the 1953 fiscal year which ends next July 1, Congress has appropriated only $195 million.

This represents only 40% of the program originally contemplated and authorized: A $1-billion program, with the federal government putting up $500 million or half its cost over a 12-year period. If this program is to be realized, it means that Congress will have to appropriate more than $300 million, or an average $60 million annually, over the next five years—an unlikely prospect.

▶ **Local Pressure**—Pressure from localities waiting for federal matching funds to build projects may result in a bigger appropriation than the $11.7 million which Congress allowed for the current year.

But even a $300-million appropriation from Congress over the next five years, paving the way for a $600-million program, would, according to CAA, fall short of meeting the nation's airport requirements.

CAA has reported that a $650,-million program, with the federal government putting up $335 million and localities the remaining $315 million over the next three years, is required to meet airport needs.

Australian Venoms

(McGraw-Hill World News)

Melbourne—The Australian Navy and Dept. of Defense Production reportedly are backing plans for de Havilland to produce at least 50 Sea Venom jet fighters at Bankstown, Sydney, to replace obsolescent Hawker Sea Fury piston fighters now used on Australia's two carriers.

De Havilland-Australia has completed three-quarters of its order for approximately 80 Vampire jet fighters for the RAAF and no further Vampire production is expected. Tests are being conducted on the two-seater Vampire trainer which has been ordered by the RAAF and Royal Australian Navy. Only a few of these will come off the lines this year.

Design Completed For New Aussie Jet

(McGraw-Hill World News)

Melbourne—A new Australian design in supersonic military jet aircraft combining American, British and Continental principles, as well as some new features added by Australian experts, has been completed at the Commonwealth Aeronautical Research Laboratories at Fisherman's Bend, here. No details are likely to be disclosed for some time but foreign experts found several features original and of potentially great use.

With production of Sabres and Canberra bombers already behind schedule, experts fear Australian productive capacity may not be able to withstand further stress. It is feared that high construction costs may make economical production impossible and no decision has been made as yet to build a prototype.

The first Australian-built Sabre jet is not expected to be ready for test flights until April 1953, and the first Canberra jet bomber will not be available for tests until February 1953.

Australian preparations for the "jet age" include plans for nearly 100 giant new jet airstrips at such places as Darwin, Townsville, Perth, Adelaide, Amberley and Williamstown. Work is expected to start as soon as funds are allocated for this purpose.

Twin-Turbine Copter Studied by Doman

A twin-turbine-powered copter, projected to meet the expanding market for rotary-wing aircraft in inter-airport and airport-to-city transportation, is under development study at Doman Helicopters, Inc., Danbury, Conn.

Availability will be dependent on certification of the powerplant—the 200-shp. Boeing 502—scheduled for use in the copter, which is projected as a conversion of Doman's LZ-5 design now powered with a single Lycoming 400-hp. piston engine. Certification of the twin-turbine copter should not be difficult because the craft would be within the present design load factors of the LZ-5.

► **Powerplant**—In the projected copter, the dual turbines will power the main rotor through a mixing gearbox. No cooling system or clutch will be required, hence empty weight of the craft will be reduced. The turbines also will have a more variable operating shaft speed. The weight reduction and the widely variable rotor operating speed should give the copter a substantial increase of both useful load and top speed, as well as twin-engined reliability.

Useful load on the LZ-5 is 2,140 lb. In the projected twin-turbine copter the useful load may be increased between 300-500 lb., probably to be achieved by upping the gross as well as dropping the empty weight.

Doman is now building a medical evacuation version of the LZ-5 for the military. Known as the YH-31, it is intended for loading to a normal gross of 4,420 lb., instead of the LZ-5's 5,000-lb. gross, to achieve desired rate of climb and altitude performance for military operation.

NWA 2-0-2 Suit Goes to Trial

The $750,000 damage suit brought by Northwest Airlines, Inc., against Glenn L. Martin Co. over alleged defects in five 2-0-2 transports opened last week in Federal District Court, Cleveland, with Judge Emerich Freed presiding.

Northwest alleges that because Martin did not use reasonable care in design, selection of materials, process of manufacture, workmanship, inspection and testing of the lower spar caps on the planes, NWA lost one of the aircraft in flight over Wisconsin Aug. 29, 1948.

Three crew members and 30 passengers were killed and the airline claims it suffered property loss of $450,000, workmen's compensation claims for the crew of $25,000 and an additional $250,000 because the other four planes were grounded to correct cracked spar caps.

Martin answers that the five planes in question were contracted for by Northwest after the airline's engineers and CAA specifications were met explicitly, that the unprecedented storm in which the one plane was wrecked was by-passed by other commercial planes while the Northwest pilot dared to plow through it.

ICAO Elections

Montreal—Dr. Edward Warner, president of the council of International Civil Aviation Organization, has announced election of three vice presidents and of chairmen of ICAO committees.

Vice presidents of the council elected for one-year terms: first vice president, Dr. Enrique M. Loaeza, Mexico; second vice president, Mohamed S. El Hakim, Egypt; third vice president, Dr. Salvatore Cacopardo, Italy.

Sir Frederick Tymms (U.K.) was re-elected chairman of the Air Transport Committee; Lt. Col. J. Verhaegen (Belgium) was re-elected chairman of Committee on Joint Support of Air Navigation Services. At a previous meeting Walter J. Binaghi (Argentina) was re-elected chairman of the Air Navigation Commission.

Air Industry Receives Materials Quotas

Defense Production Administration says it has alloted defense and civil aviation about all their requirements for controlled materials—steel, aluminum and copper.

Ralph S. Trigg, DPA deputy administrator for program and requirements, says DPA has adhered to its policy of granting military and atomic energy requirements—despite the steel shortage.

Defense allotments for the first quarter of 1953 total 2,271,000 tons of steel, 268,160 tons of copper and 258,000 tons of aluminum. NPA Aircraft Section got 6,116 tons steel, 1,094 copper and 9,692 aluminum for civil aircraft. The only cut affecting airlines was an 11% reduction in nickel stainless steel for maintenance repair and operation supplies—used for such items as repairing aircraft firewalls—but the airlines will be able to absorb this temporary reduction in their stated requirements, according to the CAA's Office of Aviation Defense Requirements.

The CAA got 12,320 tons of steel, 540 copper and 416 aluminum for its airports and airways needs.

Committee Reviews Air Base Program

Air Force is taking a second look at its long-range $10-billion air base construction program. A Projects Installations Committee aimed specifically at reviewing construction programs has been established with Assistant Secretary E. V. Huggins as chairman.

Air Force action follows hearings before Senate Committee on Military Appropriations last spring when charges were made that USAF was building too-plush bases and engaging in lax construction practices, particularly in North Africa and Greenland.

Air Force will come in for the largest share of the $3-4 billion in military construction programs that the Pentagon will ask from Congress next January as the first step in the program. Top brass feared drastic cuts might result in wiping out some bases. That is why the Projects Installations Committee was established.

To make sure programs get a thorough going-over, spade work on the detailed research and review of proposed construction programs will be undertaken by private contractors who will report to the committee.

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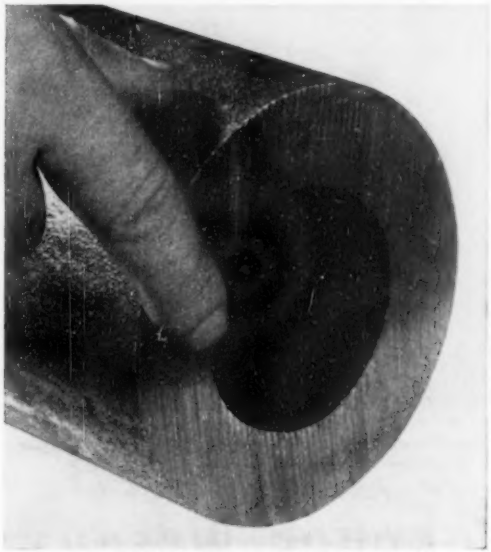

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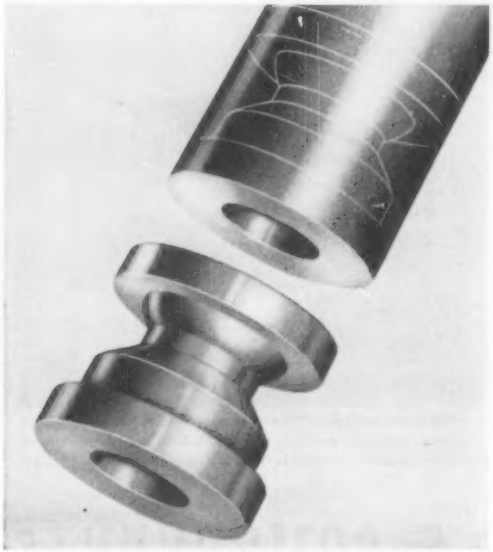

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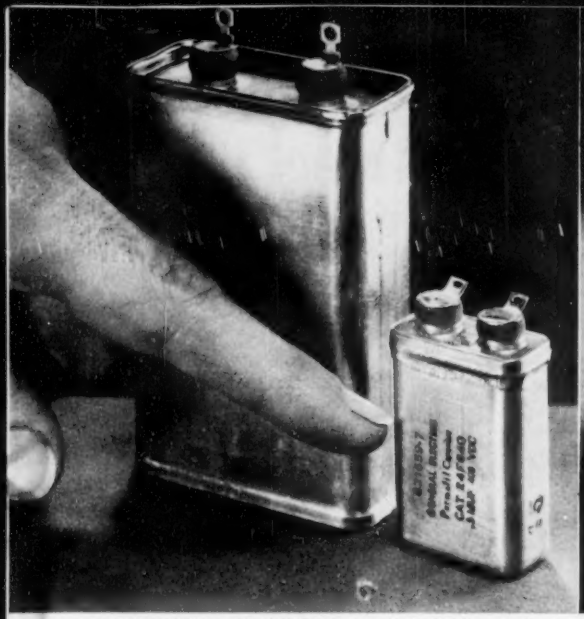

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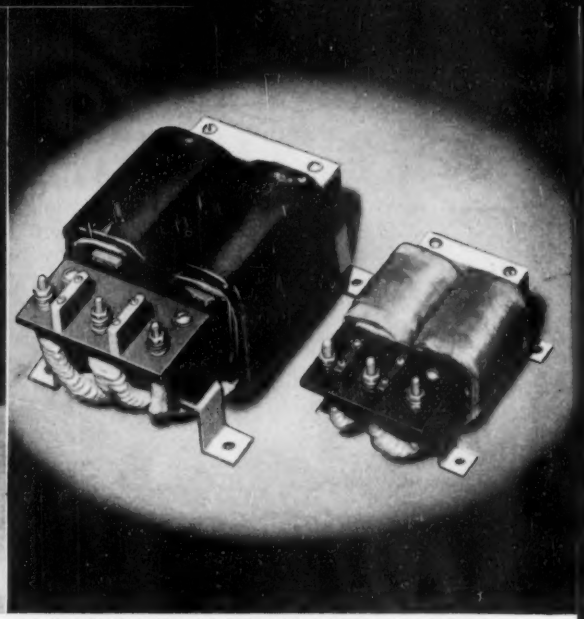

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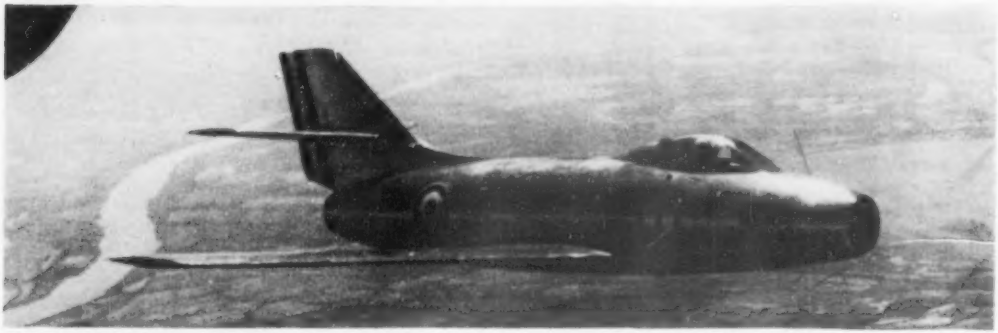


MYSTERE PROTOTYPE, M. D. 452 Mk. 1, is basically a sweptwing version of M. D. 450 Ouragan, powered by a Rolls-Royce Nene.

Exclusive Report on M. D. 452 Mystere

- **In the sweptwing Mk. 2, the French have one of the five best jet fighters now in production.**
- **This is the finding of Aviation Week's engineering editor after first-hand study of the plane.**

By David A. Anderton

Paris—Marcel Dassault's Mystere 2 is the best thing that has happened in the French aircraft industry since the Spad.

With performance that matches both the MiG and Sabre, plus a heavier punch than either, the sweptwing Mystere 2—one of the five top fighters in the world—is in production for the French Air Force. Its predecessor, the straight-winged Ouragan, is in squadron service. The newer Mystere 4—which will compare to tomorrow's USAF fighters—is coming along to follow the Mk. 2 down the production lines.

Heavy U. S. financial backing of the Mystere for fiscal 1953 off-shore procurement has followed an evaluation of the airplane as a producible weapon by a joint team of U. S. military and civilian specialists (AVIATION WEEK Oct. 13, p. 13). This makes the Mystere a stable item in an industry which has long been noted for instability.

▶ **Misunderstanding**—Many U. S. and British observers are inclined to dismiss the Dassault effort—and in fact, the whole French aircraft industry—with a few erroneous generalizations. One of these is a supposed lack of production ability and space. Another is the purported lack of armament, equipment and even instruments which makes the airplanes lighter and therefore helps their performance. A third is the chronic distrust of anything foreign.

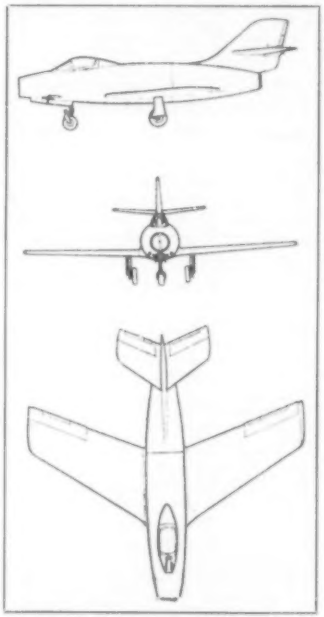
The battle of press releases staged last spring by the Mutual Security Agency and the USAF didn't help the Dassault cause any. MSA's release was over-enthusiastic about the Mystere as compared to the F-86 Sabre, basing its joy on evaluation flights conducted by a top USAF pilot team. Air Force countered with a story different in details, which didn't effectively deny the MSA arguments.

Final truth about the Mystere will never come out until the type has been battle-tested. Meanwhile, AVIATION WEEK presents this exclusive analysis of the airplane and the production possibilities of Avions Marcel Dassault.

▶ **The Airplane**—The Mystere 2 is a single-jet, single-place interceptor, with low wing swept at about 30 deg. at quarter-chord.

The prototype Mystere 1 was powered by a Hispano-Suiza Nene, built under license from Rolls-Royce, and rated at 5,000-lb. sea level static thrust. Production versions—Mystere 2—will feature two powerplant installations: H-S Tay, centrifugal-flow engine, rated at 6,200 lb. sea level static thrust, or the Atar 101C, axial-flow jet, rated at about 6,500 lb. sea level static thrust.

The prototype first flew in February 1951; the first pre-production Mystere 2 was delivered to the company's flight test base at Villaroche in July 1952; the second pre-production ship followed in September.



Marcel Dassault Mystere Mk. 2.

Peak production of the craft will be reached by March or April 1953; first orders total 340 complete airframes.

▶ **Structure**—The Mystere is conventionally divided into major components of front and rear fuselage, wings, and tail surfaces. With the exception of engine ducting, which differs in the two ver-

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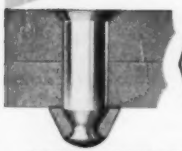

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DASSAULT PLANT at St. Cloud, near Paris, is experimental factory for fighters.

M.D. 452 MYSTERE fixtures at Merignac plant are set up on pipeframe castings.

sions, the structure of the Tay-powered and Atar-powered Mysteres is identical.

The ducting, which splits around the pilot's cockpit, joins again to feed the Atar's axial-flow compressor. For the Tay, the ducts feed a plenum chamber.

Fuselage breaks at the wing trailing edge for engine accessibility and change. Both front and rear sections of the fuselage are excellent examples of monocoque construction; there are many light rings and stringers forming the multicelled structure.

The finish of the airplane is magnificent, better in fact than any other aircraft I have seen. Skinning is Alclad, even on the tapered sheet sections, and it has been handled with great care. The result is a glistening airplane which, from a slight distance, looks as if it were sculptured out of a block of metal instead of being made up from bits and pieces.

Span of the Mystere 2 is about 36.8 ft., and overall length is almost exactly the same. Characteristic lines of the Dassault fighters have been retained, except all surfaces have reduced aspect ratios compared to the Ouragan, immediate predecessor of the Mystere.

► **Performance**—Specific performance data are classified. But foreign technical observers have commented on several outstanding characteristics of the Mystere 2.

For example, as an interceptor, it gets off the runway in about 2,000 ft.; in landing, it comes to a complete stop in about 2,300 ft. after touchdown.

Initial rate of climb is up around 10,000 fpm., attributed to the light weight of the aircraft—equipped, the Mystere 2 weighs in at less than 13,000 lb. with full tanks and ammunition.

Altitude performance of the type is also exceptional, deriving from the relatively low wing loading (estimated at about 40 psf. for takeoff, and down around 35 psf. after climb to altitude) and the altitude behavior of the Tay.

Rate of roll of the Mystere is above

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Los Angeles

THE CENTER SECTION of the windshield on McDonnell Aircraft Corporation's F2H-3 Banshee is precision-ground, bullet-resisting Pittsburgh Multiplate Safety Glass. This newest version of the Banshee series features a longer fuselage, improved radar, more powerful armament and increased fuel capacity.

McDonnell's newest Banshee fighter features windshield of Pittsburgh Multiplate

HERE's the latest version of the carrier-based, twin-jet McDonnell Banshee—the F2H-3—relied on by the Navy as one of its most powerful counter-weapons against high altitude bombers. It incorporates many design improvements, but, like its predecessors, makes use of a windshield center section of Pittsburgh Multiplate Safety Glass.

The windshield is precision-ground, bullet-resistant glass of the gunsight reflector type. It is designed for maximum possible light transmission under all conditions—dusk or dawn, daylight or even night fighting.

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the average, due in part to its power-boosted ailerons.

► **Impressions**—The Mystere is a small airplane, a compact fighting machine with a minimum of non-essential equipment.

You climb into the cockpit with the aid of a curved ladder and sit in the Martin patent ejection seat. You can't see the rudder pedals, but you know where they are. You feed your feet through "slots" below the panel and settle your heels into the pedals.

The cabin rails seem to touch your shoulders on each side. Every square inch of cockpit area is used. Straight ahead are the conventional instruments and controls. Small panels at left and right contain auxiliaries. A pair of long, thin panels which contain switches for services and armament extend from the region of each elbow to each knee, running on the diagonal down the cockpit side.

A vertical console with more instruments is mounted behind the control column—it is this feature that gives you the impression of slots cut out for your legs and feet.

Ahead of the flat-fronted windshield are a pair of external VHF whip antennas, giving a curious bug-like appearance to the nose. On either side of the cockpit is painted the famous Indian-head insignia of the Lafayette Escadrille; markings are for Col. Rozanoff, Dassault's chief pilot and commanding officer of the Escadrille during the World War II.

► **Outside the Plane**—A walk around the airplane is revealing. You see the close-set Messier landing gear, which has a narrower tread than would seem desirable. In spite of that, no Dassault airplanes have been lost because of landing accidents, although one was banged up during a formation touchdown by a trio of French Air Force pilots.

The dorsal fin area has been reduced on later versions of the Mystere, giving the appearance of a somewhat larger vertical tail.

Neat latches are used for all flush doors. A knurled area marks the pressure point, and a powerful shove with a thumb pops out a handle big enough to grab. These are the flushest flush latches known to me.

In addition to the superb finish, there are outstanding examples of metal sculpture all over the airplane. Of these, the best is the nose inlet, hand-crafted from spinnings. A vertical splitter divides the inlet, and the leading edge of the splitter contains a pair of small intakes for cabin air conditioning.

Trailing edge of the cusped symmetrical low-drag section is blunt, and about ¼-in. thick. In plan view, the wing trailing edge differs from the usual straight run.

► **Next in Line**—Dassault people are

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Transmitters	AY201-1	26V, 400~, 1 ph.	225	1.25	25+j115	11.8	9.5	3.5	15
	AY201-4	26V, 400~, 1 ph.	100	0.45	45+j225	11.8	16.0	6.7	20
Receivers	AY201-2	26V, 400~, 1 ph.	100	0.45	45+j225	11.8	16.0	6.7	45
Control Transformers	AY201-3	From Trans. Autosyn	Dependent Upon Circuit Design				42.0	10.8	15
	AY201-5	From Trans. Autosyn	Dependent Upon Circuit Design				250.0	63.0	15
Resolvers	AY221-3	26V, 400~, 1 ph.	60	0.35	108+j425	11.8	53.0	12.5	20
	AY241-5	1V, 30~, 1 ph.	3.7	—	240+j130	0.34	239.0	180.0	40
Differentials	AY231-3	From Trans. Autosyn	Dependent Upon Circuit Design				14.0	10.5	20

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AY-500 (PYGMY) SERIES

Transmitters	AY503-4	26V, 400~, 1 ph.	235	2.2	45+j100	11.8	25.0	10.5	24
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(Advertisement)

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.

His title is Air Force quality control representative, but most people refer to him as "the inspector."

At the Wm. R. Whittaker Co., Ltd., he's regarded as a tremendous asset . . . a cooperative, fair-minded associate, a man who can run down discrepancies, beat problems, turn up information.

Actually, he is not one, but three men . . . the three resident Air Force inspectors at the Whittaker Co., and they do the same work that required perhaps fifteen men in World War II.

Their job is to check Whittaker's quality control system, to function as on-the-ground "double-checkers" of the company's own inspection procedures.

Theirs is a standard and continuing operation that follows a methodical schedule. Sometimes it takes them up to three months to complete the checking cycle. This week, when I talked with them, they were studying tools and gauges. Next week they might be on purchase order procedures, drawing control, stamps and records, jigs and fixtures or sampling methods.

They are interested mainly in performance as it relates to Whittaker's Air Force-approved inspection manual for purchasing, manufacturing and shipping. They make regular spot checks of various procedures and production items, paying special attention to those points most critical in the final application of the product.

Under its approved quality control rating, it's up to Whittaker to see that its production meets all requirements. The Air Force men simply check to see that that responsibility is being met.

One of them explained:

"Sure, we uncover little bugs here and there at Whittaker; you find them in all plants. But the rejection rate here is exceptionally low."

These Air Force representatives are federal civil service employees, working directly under the Los Angeles Regional Office of the Air Materiel Command and reporting to Major Henry Bottoms, Chief, Quality Control Branch.

They follow all contracts and purchase orders closely, matching requirements with Whittaker performance according to established procedures. They're busy indeed, for the assembly lines turn out hundreds of different valves under sub-contract to the primes or on direct government order for the military.

When they find a discrepancy it is taken up immediately with Whittaker's chief inspectors, Bob Dalton at Vernon, or Ernie Reynolds at Hollywood, and remedied immediately.

I wondered if anyone at Whittaker regarded the Air Force representatives' work as "interference," and resented it. "On the contrary," advised Ernie Reynolds, "there is close and complete cooperation between our company's inspectors and Air Force inspection men."

Until a short time ago, the Navy as well as the Air Force maintained inspectors at the Whittaker plants. Today the Air Force handles quality control representation for Whittaker's Navy production as well as its own. This cooperative system reduces government inspection costs.

While they are called on in special cases to witness laboratory functional tests or to check out a vital emergency order, this Air Force assignment is that of painstaking routine. Such routine is easier, inasmuch as Whittaker is functioning under single standard quality control . . . with all items, both government and commercial, built to government specifications.

The biggest headache, according to the Air Force men, is the voluminous paper work required of this operation, including a full daily report of all activities in quality control.

This, then, is the "behind the scenes" story of "source inspection" . . . and through this story, I salute the men who make it work . . . the Air Force quality control representatives.

most proud of their Mystere 4, still on the secret list. This plane, which made its first flight late in September, is a cleaned-up Mystere 2.

New features on the Mystere 4 include a wing with more sweep and a thinner section. Sweep angle has been increased to about 40 deg. Alterations have been made in fuselage lines, changing them from circular to egg-shaped, with the larger dimension at the bottom. The flat-front windshield of the Mystere 2 has given way to a V-front panel on the 4. The canopy is longer and thinner.

Powerplant for the new craft is reported to be either a Pratt & Whitney J48, built under license by Hisso, or the Atar 101D.

▶ **Other Fighters**—The Mystere followed from Dassault experience with the Ouragan, currently in squadron service with the French. Ouragan is a straight-winged conventional jet interceptor, powered by a Hisso Nene.

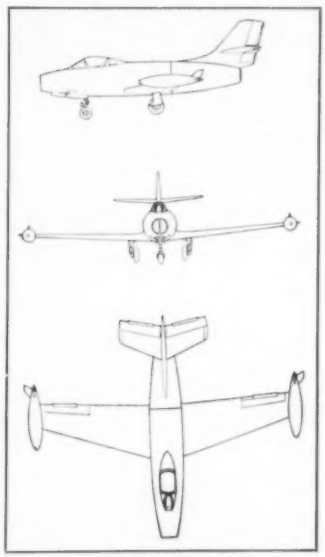
Armament of the Ouragan is four 20-mm. cannon. Cockpit is pressurized and an ejection seat is installed.

Ouragan has a wingspan of 39.3 ft. without tiptanks and 42.8 ft. with tanks. Overall length of the plane is 35.3 ft., and three-point height is 13.6 ft.

Basic structure of the Ouragan is the same as the Mystere.

The Mystere de Nuit is a further development of the basic Mystere airframe. Nose of the plane has been redesigned with side inlets and a two-place cockpit. Otherwise it is the same as the production Mystere.

Gross weight is up around 18,000 lb. It is flying with the Hisso Tay without



M. D. Ouragan

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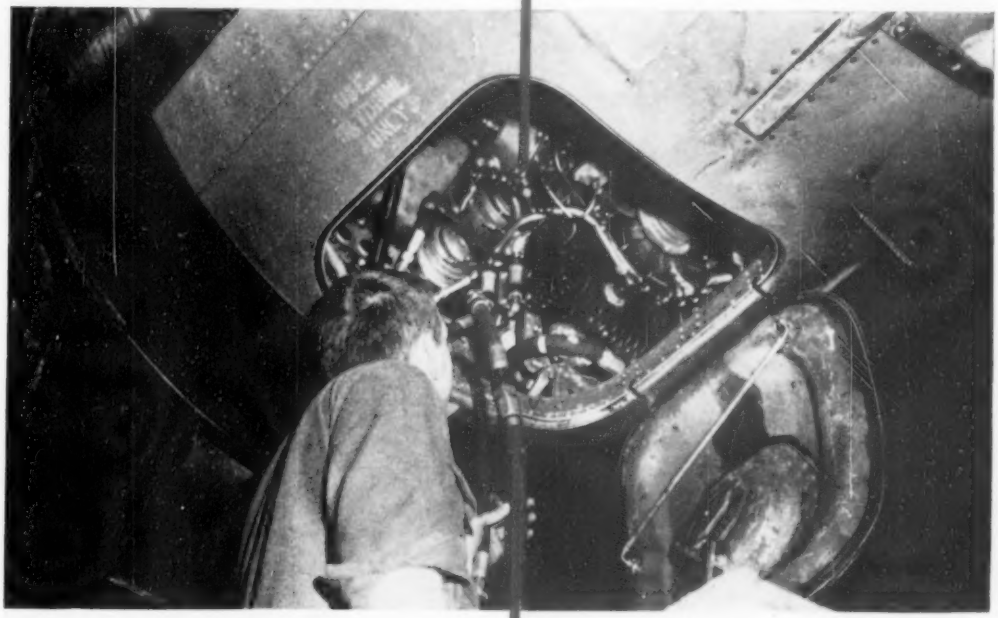

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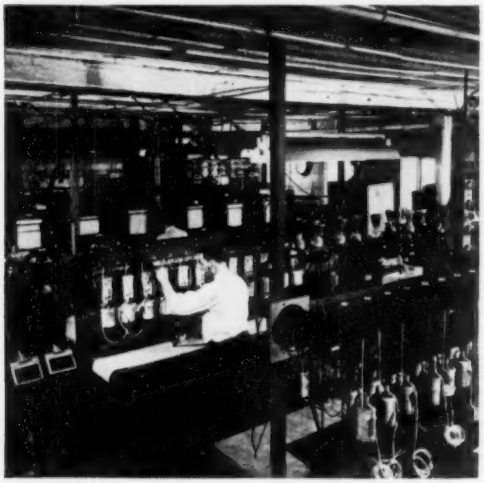

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Mystere Development

- **M.D. 450 Ouragan,** first postwar jet design, featuring straight wing and Nene powerplant. Now in squadron service and production.
- **M.D. 451 Aladin,** proposal for night-fighter based on Ouragan. Design only.
- **M.D. 452 Mk. 1 Mystere,** the prototype, basically a sweptwing version of the Ouragan, powered by a Nene.
- **M.D. 452 Mk. 2 Mystere,** the production version, powered alternately by the Hisso Tay or SNECMA Atar 101C.
- **M.D. 452 Mk. 3 Mystere de Nuit,** a sweptwing night-fighter version, also known as the M.D. 453.
- **M.D. 452 Mk. 4 Mystere,** latest prototype of Mystere line, with increased sweep and thrust.

afterburner; expected performance is transonic.

A modified Ouragan with side inlets served as a test vehicle for this powerplant installation.

▶ **Factory Space**—Dassault operates a complex of six plants, in which it produces the Ouragan, the M.D. 311 (twin-engined light transport), and propellers. Total employment is only 2,500, but 25,000 French aircraft workers throughout the industry help to build Dassault planes.

Factory sizes are small by U. S. standards. Here's how they stack up:

- **St. Cloud, near Paris,** 250,000 sq. ft. This plant is the engineering and experimental factory for fighters.
- **Argenteuil, near Paris,** 260,000 sq. ft. This is for production of fighters.
- **Villaroche, near Melun,** 100,000 sq. ft. This is the experimental flight-test site.
- **Merignac, near Bordeaux,** 220,000 sq. ft. This is the assembly line for fighters and the twin-transport.
- **Talence, near Bordeaux,** 100,000 sq. ft. This facility handles production of components for twin-engine transports.
- **Casablanca in Morocco,** 60,000 sq. ft.

I visited three of these sites—St. Cloud, Merignac and Villaroche. The plants are all cut from the same cloth. Postwar architectural practice with a French flair has produced a series of light, functional buildings of exceptional beauty for factories.

High sawtoothed roofs are supported on a spidery, pale-green trusswork built of light structural steel sections. Walls and floors are a light grey. Light reflectivity is high, which makes for good working conditions.

▶ **Machinery**—Dassault's prototype shop is well-mechanized. Machine bays are closely spaced; tools are a mixture of French and foreign types. All the machinery is general purpose—there are no special tools, such as Hydrotels.

Labor situation is excellent, and good

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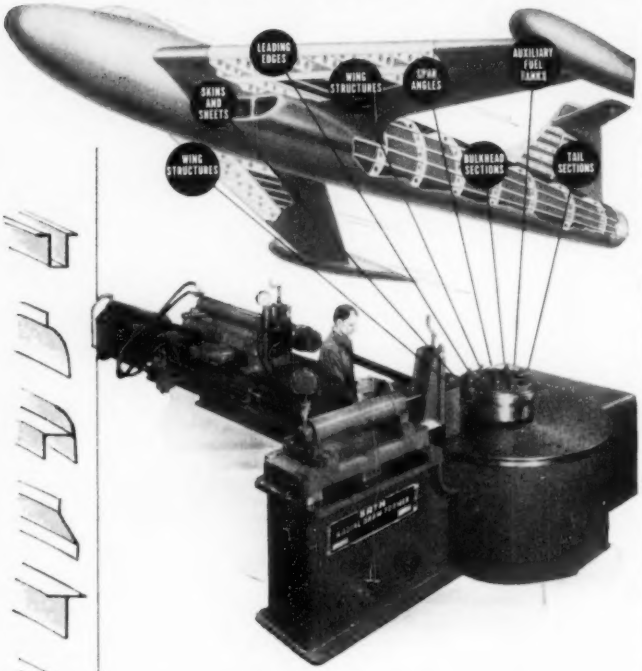

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relations are enjoyed between management and the unions. Dassault has had no major strike, has lost almost zero time since war's end. At St. Cloud, the Dassault shops are only a few doors from the ancient Bleriot plant, active in World War I and earlier. The labor has been there since there has been a French aircraft industry.

A motorcycle is awarded to the best worker at the St. Cloud plant each month, a practice which has been in existence for three years. There are a few women workers in the Merignac factory, but none at St. Cloud. This latter shop also has the craftsmen—the average workman has great pride in his job and regards himself as a Rodin in metalwork. Consequently you get the best kind of workers you could want for an experimental shop.

► **Production**—The Ouragan is currently the big production effort at the Dassault factories. Original order for this craft was for 450, but this was later cut back to 350, and the 100 removed were converted to Mystere orders.

Production is supported by extensive subcontracting to the French nationalized factories of the Southeast and Southwest. SNCASE builds the forward fuselage section, and SNCASO builds rear fuselage and wings. The tail surfaces are fabricated at Dassault's plant at Argenteuil near Paris.

First production Ouragan was delivered in January 1952. By the end of the year, 55 will have been delivered. Peak production rate of 22 per month will be achieved by February 1953.

Scheduled production of the Mystere 2 is being phased in now, with pre-production prototypes in the flight-test stage. Tooling and jigging is well along, and all stocks have been purchased. There have been some delays in the program because of the routines of offshore procurement policies. But Dassault is ready to go, and is in limited production of the Mystere 2.

NATO would like to see the firm start production of the Mystere 4 as soon as possible, because of the performance gain over the Mystere 2. This decision is still up in the air.

► **Techniques**—Assembly fixtures at the Merignac plant have the standard pipe-frame castings developed by the Germans during World War II. (In the U. S., Republic Aviation Corp. pioneered this system—AVIATION WEEK June 18, 1951, p. 27.)

With such a system, mobility of jigs and fixtures is easily achieved, because the parts are like those of an Erector set. They can be set up quickly, knocked down, shipped to other factories and be set up again in minimum time. Changes from one kind of airplane geometry to another can be made quickly and cheaply.

In combination with these fixtures,

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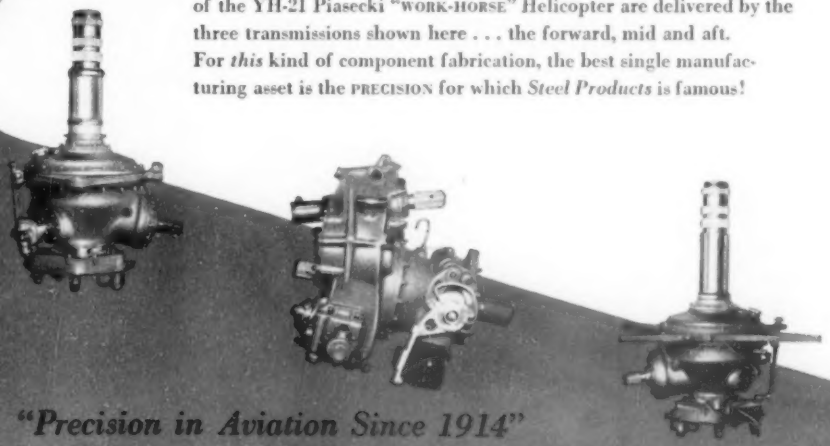

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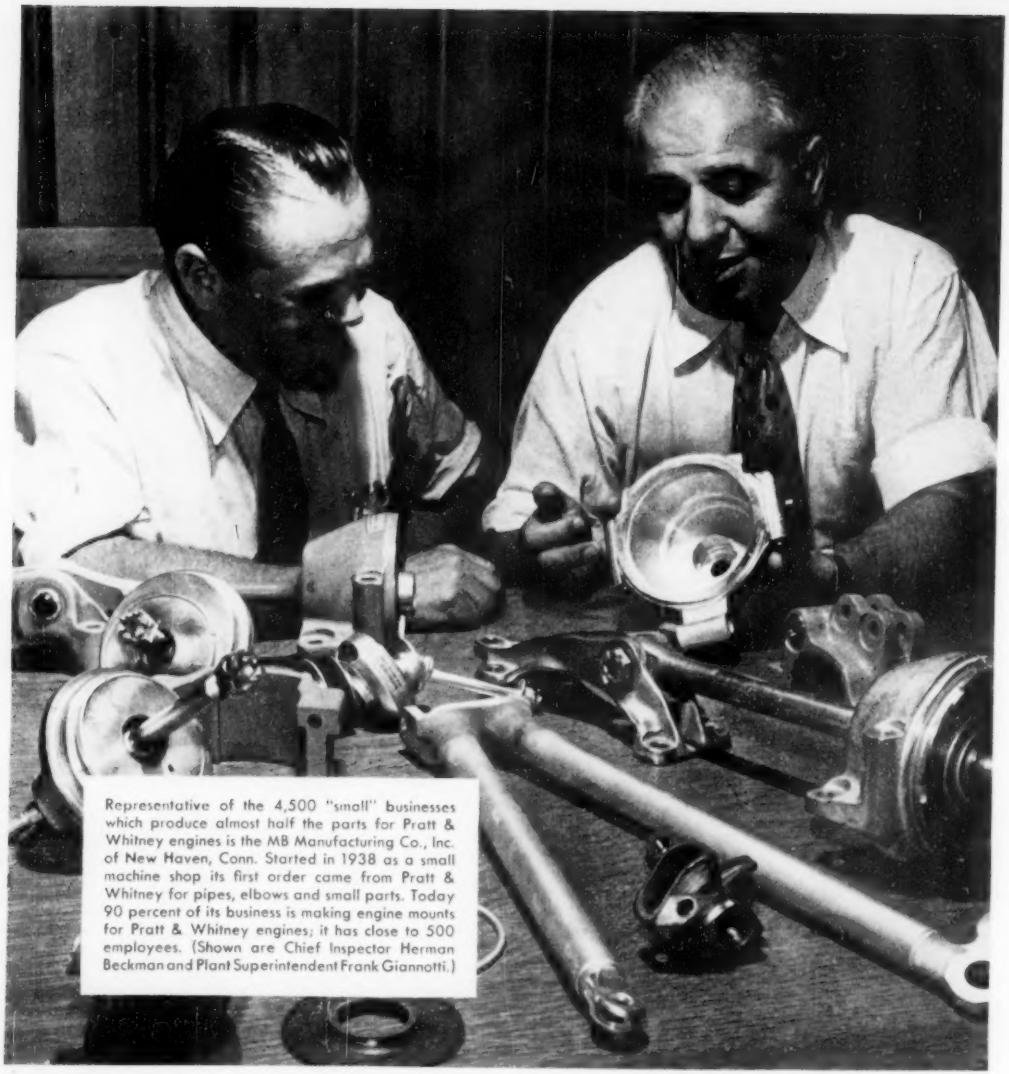

Representative of the 4,500 "small" businesses which produce almost half the parts for Pratt & Whitney engines is the MB Manufacturing Co., Inc. of New Haven, Conn. Started in 1938 as a small machine shop its first order came from Pratt & Whitney for pipes, elbows and small parts. Today 90 percent of its business is making engine mounts for Pratt & Whitney engines; it has close to 500 employees. (Shown are Chief Inspector Herman Beckman and Plant Superintendent Frank Giannotti.)

helps do a Big Job

4,500 of Pratt & Whitney Aircraft's 5,000 Suppliers are "Small" Businesses

THE FACT that thousands of small businesses play a very big part in Pratt & Whitney Aircraft's production is far from accidental.

Some 27 years ago, when Pratt & Whitney Aircraft itself was a small business, its founders established the principle that approximately half of the work load should be borne by outside companies. Over the years this has meant that thousands of companies all over the U. S. have joined the ranks of its regular suppliers.

Now it has reached a point where there are over 5,000 subcontractors and suppliers furnishing parts, materials and supplies necessary for the building of Pratt & Whitney engines. Significantly, 90 percent of these suppliers—4,500 out of 5,000—are "small" businesses, firms with less than 500 workers.

Achieving production on such a broad base is something that could only be found in America. It is a typical example of how big business contributes its organizational ability, its engineering resources, and its know-how to make it possible for smaller businesses by the hundreds to share in major production assignments.

All Americans benefit by this type of teamwork. The task of providing equipment for the armed forces is not confined to a few big suppliers. Instead, large prime contractors like Pratt & Whitney, who alone have the resources to develop major items of military equipment, generate enough production assignments to keep thousands of medium and small sized companies busy helping to stock the nation's arsenal.

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Dassault uses a form of optical tooling. Alignment of end points at wingtips or fuselage extremities is made on a ground glass target. This target is part of a box assembly set into the floor. Lenses focus the fixture lines onto a grid laid out on ground glass. Adjustment is precise and quick.

► **Line Set-Up**—The Merignac factory is laid out in the traditional assembly line. A row each of Ouragans and the twin-engined transport move towards the big doors at the apron end of the assembly plant.

Components are received at the sides and either stored on a balcony or fed into the assembly line.

Planes progress through functional tests—made with a variety of ingenious console-type checkers—to the flight-test hangar located at the left of the assembly area. In the flight-test hangar, the planes are weighed and given final checks, then taxied across the field to the flight line for flight tests and delivery.

► **Personals**—Any visit such as this one leaves you with a lot of personal observations and opinions. Rounding these all up might give the following:

Dassault's has an enthusiastic, capable staff with lots of drive. They have designed and developed the Mystere 2 to a point where it is comparable to the current production fighters of Russia and the United States, except that it isn't in full production yet.

They have a better fighter, the Mystere 4, at a stage where it could be put into production shortly. If this were done, it would bolster the French Air Force with a first-line fighter which would not be inferior to its contemporaries when it got into service.

Production at the Merignac factory could be trebled if labor could be brought in. There is ample space to do this.

Dassault's total effort is small compared to American standards, but large on an absolute scale. The company is building one of the best fighters in the world, a tribute to the design and engineering talent which Dassault has gathered around him. They have quickly grasped the best in production techniques and adapted them to their own use.

The quality of their workmanship is not equalled by any other manufacturer of aircraft known to me. The quantity appears to be on a par with the largest British firms.

Individual activity is high, seems greater than that in the British plants I visited, and comparable to American workers at their best. Morale is extremely high, and matches workers' pride in their product.

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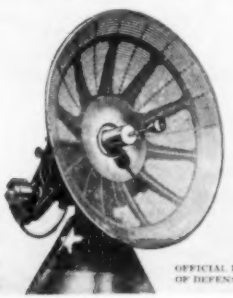

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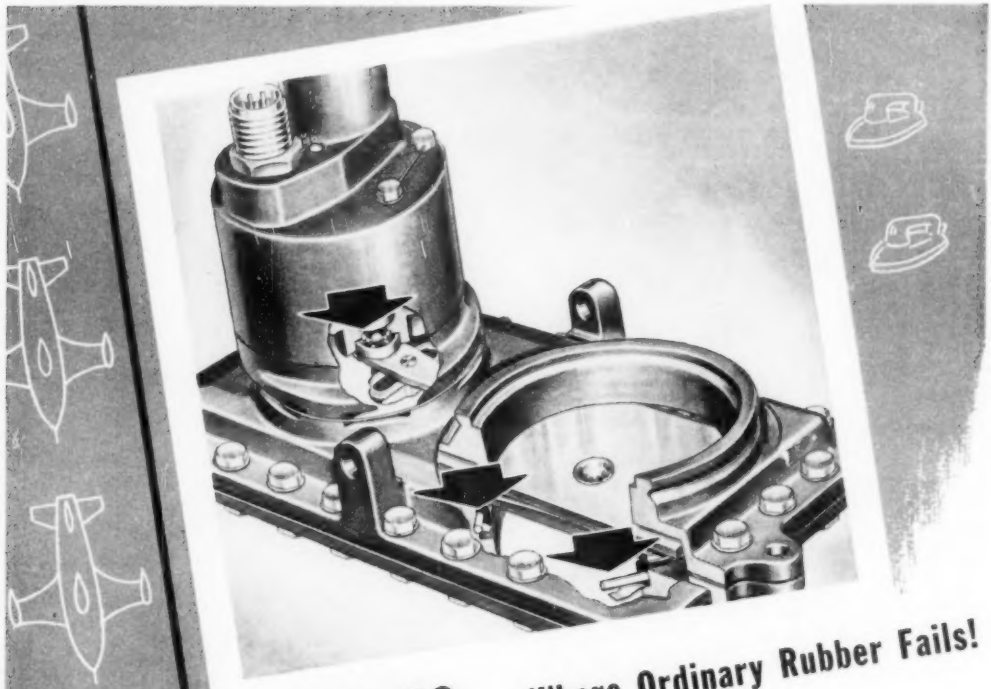

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Dassault's production becomes really effective, and that is the question of Mystere 2 versus Mystere 4. With that out of the way, and with the considerable experience of the Ouragan to build on, the contribution of Avions Marcel Dassault to the defense of the free world will be substantial.

THRUST & DRAG

Back in the days when airplanes were built with chisels and sewing machines, static testing was a simple procedure. You turned the airplane upside down, and loaded sandbags on the wing in what you thought was an approximation of the loads. By and by you either ran

out of sand (thus proving the structure) or the wing broke. In the former case, you went out and bought drinks; in the latter case, you went out and bought drinks.

Above is a typical test rig of an earlier day—1912, to be exact. The airplane being tortured is a Bristol Coanda.

* * *

Usually a person using an alias tries to conceal the fact, but Marcel Bloch, famous French aircraft designer, is proud of his. That's why his factories and planes bear the name of Marcel Dassault.

Bloch was responsible for the Bloch 152 fighter and the 175 bomber used by the French Army of the Air in the 1939-1940 fighting. Came the occupation and Bloch went underground, using the name of Dassault as a cover. This adventure was interrupted by deportation to Buchenwald; Dassault was liberated in April 1945 by GIs.

He reorganized his aircraft business under his new name, starting on a modest scale with repair of engines and manufacture of propellers. His proposals for the Ouragan interceptor followed, and this led to the sweptwing Mystere, one of the five best fighters in the world.

* * *

British test pilots, like their American counterparts, combine the best qualities of hot pilot and cold engineer. For their exacting work, the annual salary varies from about $3,400 to $5,600.

In the postwar period, more than 20 British test pilots have been killed, mostly in jet aircraft. —DAA

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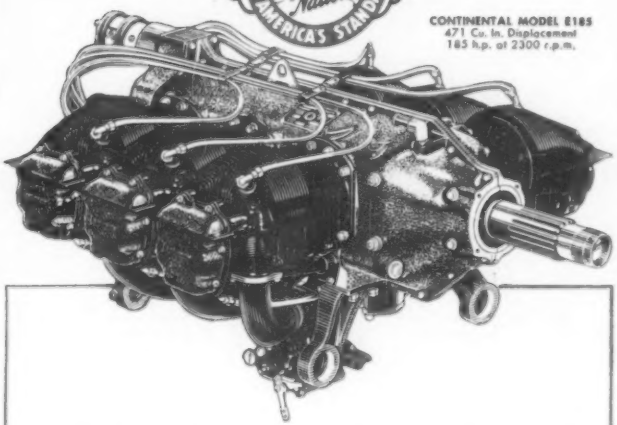

IT IS a tribute to the quality of Continental engines, as well as to the judgment of corporate and individual owners of utility type planes, that an overwhelming majority of such planes in use today fly with dependable Continental Red Seal power.

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NEW STANDARD D-C CONTROL PANEL BUILT TO USAF EXHIBIT No. MCREXE22-89A

Here is the new standard d-c control panel. This compact lightweight panel embodies outstanding Westinghouse contributions to the regulation, control, protection and maintenance of d-c aircraft systems.

Many of the built-in features are the result of successful use in other Westinghouse panel designs . . . your guarantee of performance-proved equipment.

The new panel is of the simple plug-in type with a voltage regulator which can be quickly inserted or removed. Vibration and shock insulators are built into the unit around the center of gravity.

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AVIATION EQUIPMENT

Space Meeting

- **Stuttgart is site of astronautic congress.**
- **Radiation danger seen as a major hazard.**

Stuttgart, Germany—Basic problems of astronautics were the general theme of the Third International Congress on Astronautics held here last month.

The 24 technical papers presented during the meeting ranged over a vast field, including the effects of cosmic radiation on living matter, the calculation of spaceship orbits, high-frequency radio for space flight and the aerodynamics of highspeed rockets.

Many of these presentations were based on individual research and were considered indicative of the kind of work that could be accomplished by small societies with limited resources.

▶ **Business at Hand**—The Congress, attended by about 50 representatives of various astronautical associations of the world, was divided into two parts.

Business of the International Astronautical Federation was the purpose of the first session; during the meeting, 16 groups from 12 countries signed the IAF constitution. The United States was represented by delegates from the American Rocket Society, Reaction Research Society, Pacific Rocket Society, Detroit Rocket Society and Chicago Rocket Society. The ARS was elected the voting member for the United States under the ruling which allows only one vote per country.

Dr. H. C. Seebohm, West Germany Minister of Transport, who opened the meeting, said that his ministry was interested in the possibility of space flight and was a corporate member of the German Gesellschaft fuer Weltraumforschung (Society for Space Research).

Because of her past record, Seebohm said that Germany should keep in touch with modern progress and contribute wherever possible.

All the speakers at the opening ceremony stressed the many problems of non-military significance on which IAF members could work. They recognized the magnitude of the problems involved and felt that international cooperation was a necessity for achieving space flight.

Dr. Eugen Saenger, well-known rocket engineer and authority on hypersonic flight, was elected president of the IAF for the second year in succession. Andrew G. Haley, of the American Rocket Society, and Dr. L. R. Shepherd of the British Interplanetary Society, were elected vice presidents.

During the session Dr. Saenger announced the creation of a chair of Astronautics at the University of Mendoza, Argentina. *(Ed. Note: This is believed to be the first such university position.)* Saenger told the AVIATION WEEK representative that he had been offered the chair.

▶ **Technical Papers**—The effects of cosmic radiation on the human body were considered in two papers, by Dr. H. J. Schaefer of the U. S. Naval School of Aviation Medicine and Prof. Dr. J. Eugster, Swiss research worker.

They said primary cosmic radiation consists of atomic nuclei of extremely high energies, coming from outer space. When these hit atomic particles in the

PROPS FOR PRINCESS: Dual and single configurations harness Proteus power.

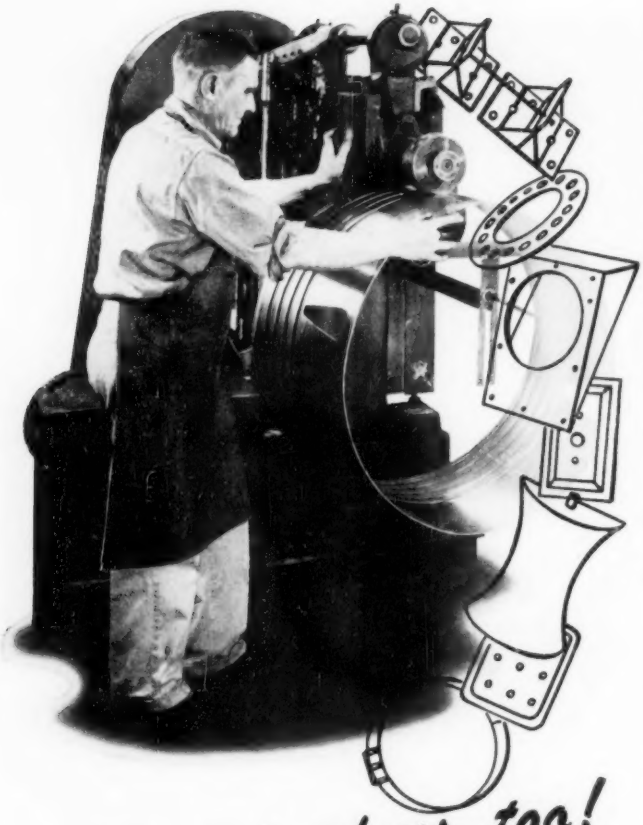
PROPS FOR BRITANNIA: Large paddle-type four-bladers team with Proteus here.

Turbine Power Turns These Props

These closeups of the engine nose sections on the Saunders-Roe Princess flying boat (top) and the Bristol Britannia show the "toothpick" and "paddle" style propellers used to convert turbine power.

The Princess' coupled Bristol Proteus turboprop engines in the inboard and center nacelles are hooked to de Havilland 16-ft. aluminum alloy counter-rotating toothpick-type props, each making up an eight-blade unit for harnessing the 7,000 shp. of each dual powerplant installation. The single Proteus engine in each outboard nacelle takes a de Havilland four-blader of the same diameter. When the Princess takes higher power engines, switch will be made to hollow steel blades.

The 16-ft. four-blade de Havilland paddle props on the Britannia have hollow steel blades, first of this makeup in Britain. Hooked to single Proteus turboprops, these units are designed to convert about 4,500 shp. into thrust—more than the engine is now yielding.



...Surprised us, too!

We looked over the list of fabricated parts we've turned out in the last ten years and we sure were surprised. All shapes and sizes!

The technique that went into these products is based on "Shop Control", the precise care that our technicians exercise in every phase of production. And it is "Shop Control" that has brought us an industry-wide reputation as a truly unique and reliable subcontractor.

Lavelle

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Earth's atmosphere, further charged particles are produced and a cosmic ray "shower" occurs. With a very high-energy particle (they can have energies up to 8,000 billion electron-volts) the shower produced can contain several million particles covering an area a mile or more in diameter at sea level.

The shower is composed of secondary particles; their distribution is well-known since most of them occur in the lower atmosphere below about 70,000 ft. But the primaries are not so well understood, and may present the major hazard—secondaries are not dangerous.

The Earth's magnetic field can deflect the primaries as they approach from outer space, and only particles possessing certain energy levels can reach the atmosphere. Minimum energy required is about 6.5 billion electron-volts at the equator falling to about 1.1 billion e.v. at the poles. Thus we have no certain knowledge that primaries with energies less than 1.1 billion e.v. exist in fact. It is these primaries that may be important from a biological point of view if they exist in large numbers.

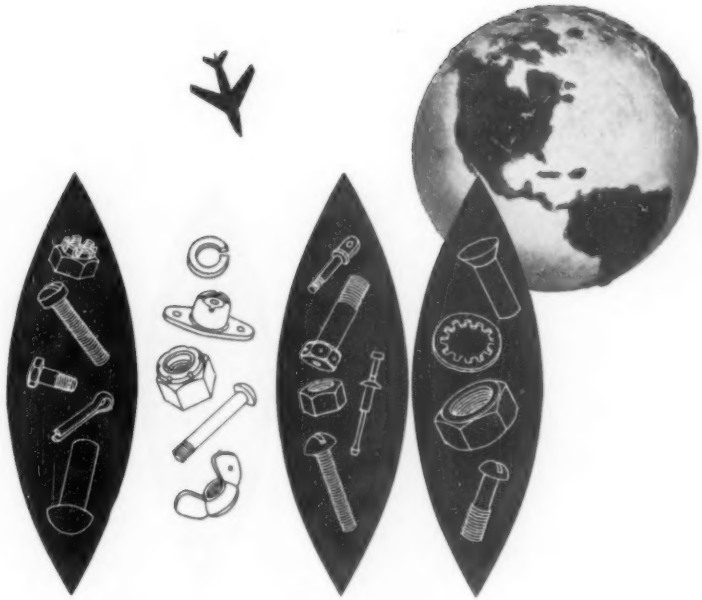
This leaves three possibilities.

- If there are no comparatively low-energy particles, space travel will be safe.
- If they do exist and are deflected by the magnetic field of Earth, then travel at a distance from the Earth will be unsafe. But how great the distance and how great the danger is at present undetermined.
- There is also the possibility that the sun has a magnetic field—though this is not yet known for certain—and so deflects some of the particles out of the solar system. Thus the inner portion of the system might be quite safe, and the outer portion quite dangerous as far as radiation is concerned.

▶**Design Details**—Dr. Wernher von Braun's paper dealt with some of the detail design problems of space stations rather than the broader aspects of overall design. Dr. von Braun, former V-2 development chief and now technical director of the U. S. Army Ordnance Missile Center, Redstone Arsenal, was unable to attend. His paper was read by Fred C. Durant, member of the ARS board of directors.

Spaceships need lifeboats, said von Braun, which might be in the form of cylindrical, self-sealing, ejectable containers. These could be rather similar to the escape capsules currently specified for highspeed aircraft, and could be slowed down by air-brakes and brought to Earth by parachute.

Oxygen supply for long trips also worried von Braun. Considerable previous study has gone into the subject, generally considering journeys of only hours or days. But the same problem for a spaceship, when the cabin might be



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sealed for months, has received scant attention.

A number of toxic materials are produced by the body, and might be dangerous if they accumulated over a period of months. The main problem is eliminating carbon dioxide; this might be solved with the use of the chlorella algae which regenerate oxygen much more efficiently than other plants.

Von Braun also stated that books published since World War II on the general subject of astronautics had done more to advance space flight than some of the billions poured into military long-range rocketry.

► **Legal Problems**—Some of the aspects of interplanetary law were considered by Dr. A. Mayer, of the Research Institute for Air Law at the University of Cologne. Dr. Mayer was of the opinion that free space, outside the Earth's atmosphere, must be considered as free territory. The space traveler would not be bound by air laws, but would be bound by a general legal obligation that his action must not endanger other traffic or persons.

Artificial satellites could be built by any sovereign state, and would be covered by the sovereignty of the state that built them, said Dr. Meyer.

Delegates to the convention also attended a special astronautical exhibit at the Stuttgart Museum held concurrently with the Congress. Much of the material on exhibit was rather elementary, but it represented a real effort to establish a solid foundation for a permanent collection.

Facts and Figures!..

Figures:

Owned by Winona Cox, Dallas payroll clerk. Brown hair, hazel eyes. 5'9", 135 lbs., 24, single. That rake (like a SAC customer) never had it so good. Winona was our November girl last year, ringing bells with admiring letter-writers all over the world, including GIs in Korea, Japan, and Germany.

Facts:

Southwest Airmotive supports, and believes in, the program of the Aviation Distributors & Manufacturers Association. In promoting greater integrity and cooperation among the manufacturers and distributors of aircraft parts and accessories, ADMA is performing an invaluable service for the entire industry. We salute this trail-blazing group and wish it well at its Annual Convention, Dec. 3-5, at The Kenilworth, Miami Beach, Fla.

Southwest Airmotive COMPANY
LOVE FIELD DALLAS

Douglas Builds Giant Static Test Setup

A static test structure that will rank second only to the facility at Wright-Patterson AFB is being completed by Douglas Aircraft Co. at Long Beach, Calif. It will cost $150,000 and will be complemented by $50,000 worth of hydraulic equipment.

The overhead structure will rise almost 40 ft. and afford a clear span of 32 ft. Foundation, encompassing 40 concrete piles capable of resisting a 50,000-lb. force, will carry a steel track with 4,500 drilled holes for attachment of hydraulic jacks and other test equipment. Jacks will be capable of exerting a force of 10,000 to 100,000 lb. in any direction.

Jobs for Engineers

Employment opportunities for aeronautical engineers exist at the David Taylor Model Basin, Carderock, Md. There are vacancies in the aerodynamics laboratory in three categories: GS-5, paying $3,410 per year; GS-7, paying $4,205 per year; GS-9, paying $5,060 per year.

The DTMB is a naval research and development facility which does a large portion of model tests on naval aircraft and missiles. The aerodynamics lab has two closed-circuit subsonic windtunnels with 8x10-ft. test sections; three intermittent supersonic windtunnels with test sections 3x5 in., 9½x9½ in. and 18x18 in. In addition, there is a 7x10-ft. transonic tunnel under construction.

Applications should be forwarded to the Personnel Division, David Taylor Model Basin, Washington 7, D.C.

Tool Men Form Research Group

Efforts to maintain and increase production knowhow are taking shape in the form of a national non-profit tool engineering research foundation. This project, sponsored by American Society of Tool Engineers, intends to make use of industrial laboratories, colleges and universities for carrying out research.

ASTE already has appropriated $75,000 as an initial contribution to assist in the establishment of the foundation, and five trustees of the organization have been elected by the ASTE board of directors.

Curved nose sections and side windows of Piasecki HUP helicopters are formed from large sheets of PLEXIGLAS II UVA. Fabrication by Steiner Plastics Mfg. Co., Glen Cove, Long Island.

Helicopters Need Big Noses . . . made of PLEXIGLAS

Pilots have to see up, down, and all around as they put helicopters through the precision paces such aircraft are called upon to perform. That's why pilots of Piasecki HUP models, shown above, are enclosed by nearly a hundred square feet of curved PLEXIGLAS acrylic plastic.

PLEXIGLAS is the standard material for transparent parts on all types of helicopters and fixed wing aircraft because it can be formed to the shapes demanded by today's designs, and because it has the strength, weather resistance, and over-all durability to do its job under severe service conditions.

PLEXIGLAS has kept pace with advances in aircraft performance. PLEXIGLAS II UVA, for example, with improved resistance to heat, weather, and crazing is used by most Air Force and Navy contractors for transparent enclosures on current pressurized planes. For the planes of the future, Rohm & Haas is working to raise the quality of transparent plastics to even higher levels.

"Eyes of Flight", a new Rohm & Haas film used by the Air Force and Navy as an official training film on the maintenance of aircraft glazing, is now available for non-military showings. It is a 30 minute, 16 mm, motion picture in color and sound. Arrangements for use of the film can be made by writing to the Plastics Department, Rohm & Haas Company.

PLEXIGLAS is a trademark, Reg. U. S. Pat. Off. and in other principal countries in the Western Hemisphere.

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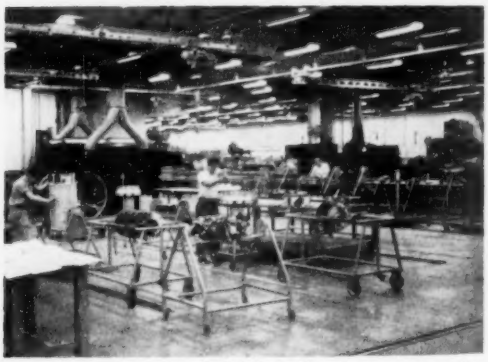
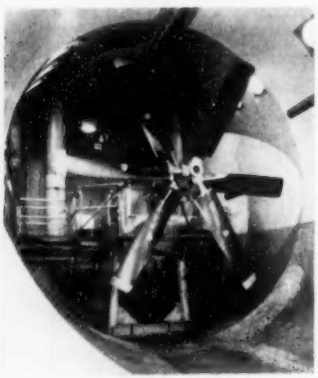
MACHINING set-ups for all T40 major components are laid out for straight-line, high-volume production. Left photo shows machining line for air inlet housing and diffuser, with reduction gear rear case line at right.



ASSEMBLY line (left) is for turboprop compressor and turbine section build-up, leading to final station at right, with completed engine on dolly in foreground. From this point the turboprop is shifted to test cells.

First U. S. Turboprop Assembly Line



TEST set-up is typical of 10 cells used to check engine and propeller.

The first facility for production in the U. S. of turboprop engines has been set up at the Allison division of General Motors Corp., Indianapolis. Here, Allison's T40 is being pushed through its early production stages.

This engine, developed for the Navy, teams two Allison T38s, driving a six-bladed, coaxial, contra-rotating Aeroproducts propeller through a common reduction gear. Each power component has 19 compressor stages, four turbine stages. Rating of the T40 is 5,525 hp.

An area of more than 250,000 sq. ft. has been set aside in Allison Plant 5 for the production job. Tooling and other plant arrangements were started in July 1951 and completed last January. Since that time, tool tryout, methods determination and final-phase production-engineering studies have been made, and the engine graduated into early production.

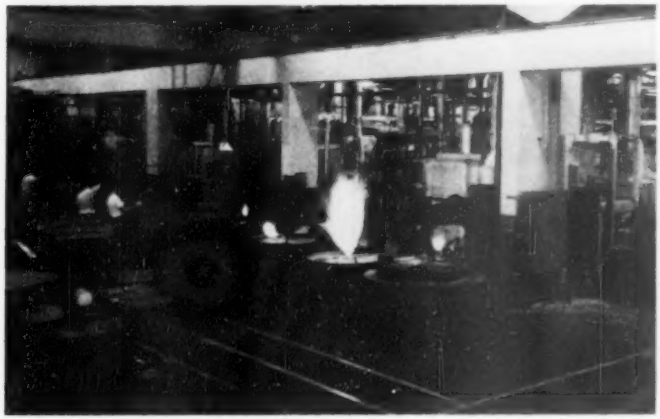
About 1,150 machine tools are involved in the production scheme. Units were obtained from Navy, Air Force, Defense Plant Corp., and Allison pools. Only 37 new machines were acquired. Many of the machines had to be overhauled and some modified for new uses.

The new facilities are set up in the same general area as those for Allison's J33 and J35. Many of the facilities can be used for all three engines.

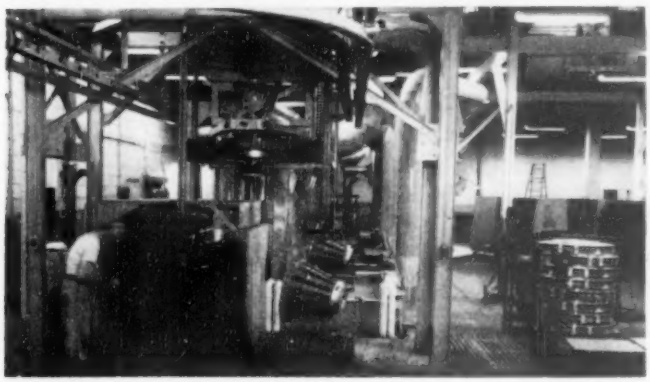
Complex T40 components of major nature are set up on a straight-line production basis. Items such as gears, shafts, couplings and other miscellaneous parts are arranged in groups for maximum utilization of equipment and floor space. T40 peak production will require about 1,000 workers.

Where Allison Makes Its T40 Engine . . .

SMALL PARTS area is arranged so that machining operations on a variety of units can be accomplished economically on one line.



HEAT TREAT department at Allison plant was expanded to accommodate T40 production. Only a portion of the heat treat area is shown.



DICHROMATING section with automatic equipment to handle J33 and J35 castings now is being used for T40 production.

This precision gear set, made by Amgears, is part of an AiResearch high speed turbine assembly operating at speeds of...

85000 RPM

Amgears offers you complete facilities for producing precision gears—in any quantity—exactly to your specifications. Open and enclosed assemblies are an Amgears specialty.

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USAF CONTRACTS

Following is a list of recent USAF contracts announced by Air Materiel Command:

Able Furniture Co., 4625 Bellaire Blvd., Bellaire, Tex., belt assembly-safety harness, 13,780 ea., $62,735.

Abrams Instr. Corp., 600-620 E. Shiawassee St., Lansing, Mich., camera, type CZR-6, 10% spare parts, data, 227 ea., 1 set, $741,426.

ACF Brill Motors Co., 62nd & Woodland Ave., Philadelphia, generator set, type A-1, 200 ea., $698,147.

Aeroflex Lab., Inc., 34-06 Skillman Rd., Long Island City, N. Y., stabilized camera mount, 18 ea., $330,236; mount, aircraft camera, 2 ea., $51,541; mount, aircraft camera, MIA-36, 421 ea., $109,232; modification kits for A-28, stabilized mounts, 14 ea., $52,888.

Aero Instruments Co., 5105 Denison Ave., Cleveland, tube, pitot, air speed, 5,881 ea., $64,103.

Aeroproducts div., General Motors Corp., Dayton Municipal Airport, Vandalia, Ohio, actuator parts, $133,196; kit assembly consisting of centrifugal breather valve, screw, washer, packing, centrifugal breather valve drill jig kit, 855 ea., 215 ea., 25 ea., $25,616.

AGA div., Elastic Stop-Nut Corp. of America, 1027 Newark Ave., Elizabeth, N. J., light assembly, 9,610 ea., clip, 12,000 ea., light beacon, 40 ea., cable assembly, 300 ea., cable assembly, 1,600 ea., cable assembly, 300 ea., connector adapter, 1,000 ea., fixture assemblies, 3,000 ea., $135,609; transformer, 16,520 ea., engr. data, 1 set, transformer, 20,000 ea., engr. data, 1 set, $576,210; lead assemblies in a/w Spec. MIL-L-6477, 104,444 ea., cable assembly-runway marker light, 5,000 ea., $1,423,016.

Air Associates, Inc., Teterboro, N. J., radio sets AN/PRC-14, 4,274 ea., $6,242,207.

Airborne Instrument Labs., Inc., Mineola, N. Y., modulators, 466 ea., $128,006.

Aircooled Motors, Inc., Syracuse, N. Y., engines, spare parts & data, $2,933,433.

Aircraft Radio Corp., 708 Main St., Boonton, N. J., capacitor assemblies, 410 ea., $18,518.

Aircraft Tools, Inc., 9030 Bellanca Ave., Los Angeles, dimpling machine, 155 ea., $339,833.

AiResearch Mfg. Co., div. of Garrett Corp., 9851 Sepulveda Blvd., Los Angeles, regulator, assembly, turbine assembly, exchanger assembly, spare parts & data, $572,929; turbine assembly, $316,398.

Air-Maze Corp., 5200 Harvard Ave., Cleveland, spare parts for refuelers, $26,681.

Alar Products Inc., 1071 Power Avenue, Cleveland 14, oxygen regulator assembly, $269,070.

Alco-Deree Co., 4300 N. California Ave., Chicago, steel bar for the NRO program, 528,750 lb., $86,259.

Allied Aircraft Co., 5536 Satsuma Ave., N. Hollywood, Calif., headband HB-7, 33,572 ea., headset HS-33A, 2,068 ea., adapter-microphone, 706 ea., headset HS-33A, 706 ea., $107,021.

Allison div., General Motors Corp., Indianapolis, J33 special tools & equipment, $200,000; J35-A-29 turbojet engines, 17 ea., $277,134.

Aluminum Co. of America, 1200 Ring Bldg., Washington, D. C., drum, 2,600 ea., $161,161.

American Bosch Corp., 3664 Main St., Springfield, Mass., spare parts, $512,698.

American Film Producers, 1600 Broadway, New York, production of a motion picture, 1 ea., $28,265.

American Pipe & Steel Corp., 2201 W. Commonwealth Ave., Alhambra, Calif., tank assembly, auxiliary fuel, jettisonable, 1,700-gal. capacity, type IV, 4,600 ea., $16,682,617.

Crescent Insulated Wire & Cable, Trenton, N. J., cable, various ft., $167,964.

Crosley Motors, Inc., 2530 Spring Grove Ave., Cincinnati, mounting MT-238C/ARC-3, $26,440; mounting MT-236B/ARC-3, 2,314 ea., mounting MT-237C/ARC-3, 2,388 ea., mounting MT-238C/ARC-3, 2,839 ea., $68,446.

Crown Office Supply Co., 218-224 S. Wabash Ave., Chicago, cabinet-filing, 727 ea., $37,160.

Curtiss-Wright Propeller div., Caldwell, N. J., kit assemblies, $41,409.

Curtiss-Wright Corp., Electronics div., Carlstadt, N. J., spare parts for Z-1B and Z-1A trainers, $605,388; spare parts for Z-1Z & Z-1B trainers, lot, $125,122; spare part for P-2 trainers, lot, $346,358.

Cutler-Hammer, Inc., 12th St. at St. Paul, Milwaukee, switch-microphone, $28,999.

Daystrom Electric Corp., 837 Main St., Poughkeepsie, N. Y., recorder unit, spare parts & data, 153 ea., $34,214.

Delco Radio div., General Motors Corp., Kokomo, Ind., AN/TRC-32 radio sets, 127 ea., $7,634,173.

Dietzgen Co., Eugene, 2425 N. Sheffield Ave., Chicago, table drawing 36x60", 42x84", 48x120", 287 ea., 37 ea., 49 ea., $40,710.

DeJur-Amsco Corp., Northern Blvd., at 45 St., Long Island City, 1, N. Y., ammeter, D.C. 50-mv, type J-1, 5,640 ea., $44,048.

DeVry Corp., 1111 Armitage Ave., Chicago, projector sets, AN/PFP-3, 3,547 ea., $3,331,586; spare parts, $26,323; projectors, $1,468,617.79; projectors, $61,900; spare parts for projectors, lenses, sprockets, $79,344.

Dixie Tallyho, Inc., Fairburn, Ga., head, breaker, aircraft tire, 322 ea., $420,866.

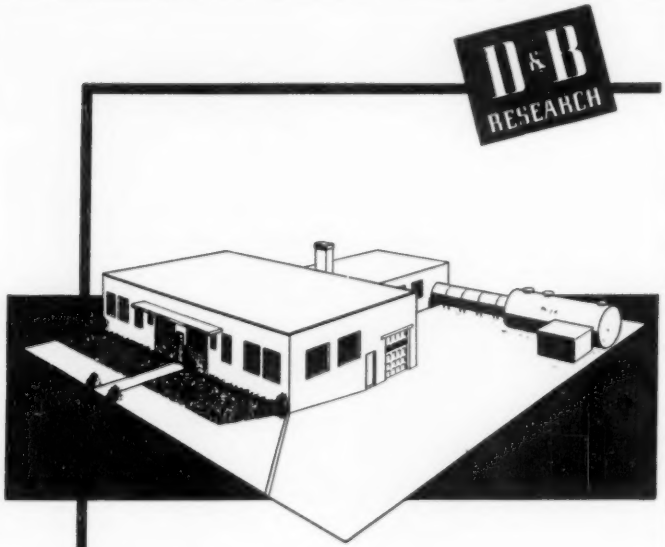
Standard Gage Co., Inc., 70 Parke Ave., Poughkeepsie, N. Y., gage, internal, indicating, 284 ea., $35,135.

Standard Pressed Steel, Jenkintown, Pa., bench work, general purpose, 2,000 ea., $81,585.

Standard Steel Works, 16th & Howell Sts., N. Kansas City, Mo., maintenance parts, $115,433.

Stewart Warner Corp., 1300 N. Kostner Ave., Chicago, radar altimeter, 935 ea., $1,141,909.

Swedlow Plastics Co., Youngstown, Ohio,



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Kansas City Office 1811 Agnes Ave. Kansas City 1, Mo.

Plexiglas spare parts, $84,697.

Switlik Parachute Co., Inc., 1325 E. State St., Trenton, N. J., parachute, 2,374 ea., harness assembly, 197 ea., pad canopy release, 248 ea., $409,865.

Sylvania Electric Products, 254 Reno St., Buffalo, N. Y., relays, 5,660 ea., $32,773.

Telephonics Corp., Park Ave., Huntington, L. I., N. Y., rec-head, 27,900 ea., $73,255.

Thompson Co., The H. I., 1733 Cordova St., Los Angeles 7, insulation-blanket, 47,890 sq. yd., $91,709.

Trad Television Corp., 1001 First Ave., Asbury Park, N. J., radio receivers, 11,058 ea., $1,315,447.

Trailmobile, Inc., 31st & Robertson Ave., spare parts, $138,937.

Tumoar Mfg. Corp., 232 George St., New Haven, Conn., harness shoulder, 3,583 ea., belt-tap safety, 12,776 ea., belt-tap safety, detachable, 5,805 ea., $136,676.

Union Spring & Mfg. Co., 1057 Summit Ave., Jersey City 7, oscillator, 560 ea., $60,480.

United Aircraft Corp., Bridgeport, Conn., skid installation kits, fuel tank installation kits, $168,996.

U. S. Gauge div., American Machine & Metals, Inc., Sellersville, Pa., transmitter, 6,027 ea., $585,495; transmitters, 520 ea., $50,817; gage, 15,310 ea., $148,127; transmitter, 3,176 ea., $33,924; gage and data, 5,993 ea., $53,458.

United Truck & Equip. Co., Inc., Baltimore 30, manifolding set, type A-2, spare parts & data, 100 ea., $364,865.

Van Bert Co., 1427 E. 6th St., Los Angeles, cushion, 6,700 ea., $36,247.

Van Norman Co., Springfield, Mass., milling machines, 21 ea., $271,530.

Viewlex, Inc., 35-01 Queens Blvd., L. I., N. Y., photographic projectors, $25,599.

Victor Animatograph Corp., Davenport Bank Bldg., Davenport, Iowa, spare parts, $35,214.

Wall, Inc., John M., 107 N. Franklin St., Syracuse 4, N. Y., miscellaneous parts, $35,573.

Walty Furnace Co., 1901 Sycamore St., Cincinnati, furnaces, electric—1. 15"W x 30"-L x 12"H, 42 ea., 2. 6¾" x 4" x 9", 97 ea., 3. 12" diameter x 18" deep, 132 ea., $233,900.

Warner News, Inc., 625 Madison Ave., N. Y., production of a motion picture, 1 ea., $100,000.

Waukesha Motor Co., Waukesha, Wis., spare parts, $75,778; spare parts, $29,708.

Weaver Mfg. Co., Springfield, Ill., brake-tester, model, Wy-40S, 122 ea., $163,596.

Western Electric Co., Inc., 120 Broadway, N. Y., auto transformer and mounting, modification kit, 193 ea., 100 ea., $49,735; combined common-battery dial, 25,000 ea., combined common-battery dial, 500 ea., combined common-battery dial, 2,500 ea., combined common-battery dial, 100 ea., combined common-battery desk set (misc. equip.), 1,200 ea., $416,857.

Westinghouse Electric Corp., 32 North Main St., Dayton, auto-transformers, 29 ea., $111,662.

Weston Electrical Instr. Corp., 614 Frelinghuysen Ave., Newark, N. J., multimeters, maintenance spare parts, handbooks, pamphlets, & photos, 18,827 ea., $1,542,868.

White-Rodgers Electric Co., 1209 Cass Ave., St. Louis, compass, 6,095 ea., $175,653.

Wire & Cable div., The Electric Auto-Lite Co., 3529 24th St., Port Huron, Mich., electric wire, 6,002,000 ft., $66,851.

Wisconsin Motors Corp., 1910 S. 53rd St., Milwaukee, maintenance parts, 93 ea., $59,924.

Wollensak Optical Co., 850 Hudson Ave., Rochester, cameras, lens and instruction books, 35 mm., $168,876.

Worthington Corp., 812 Race St., Cincinnati, portable air compressors, 1,001 ea., $1,763,901.

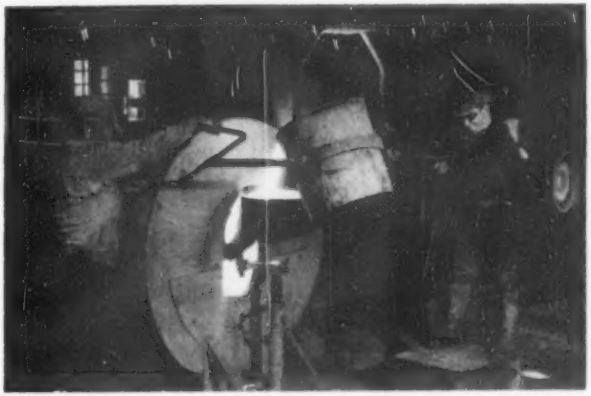
Wright Aeronautical, Curtiss - Wright Corp., Wood-Ridge, N. J., special engine tools, 50,000 ea., $1,805,000.

Wysong & Miles Co., 625 Fulton St., Greensboro, N. C., machine, sheet metal, combination, $58,900.

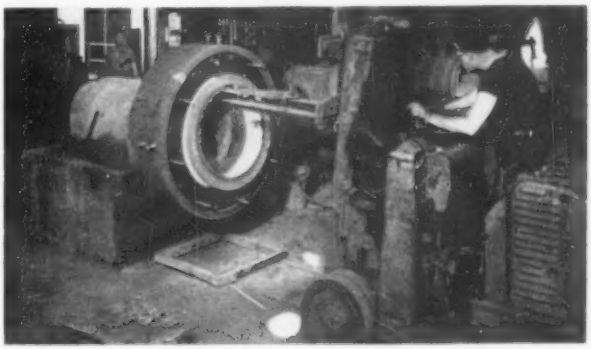
Yardley Industries, 138 Parsons Ave., Columbus, Ohio, water supply kit-type 02A, spare parts, 251 ea., $173,690.

Yates American Machine Co., Beloit, Wisc., lathe, 93 ea., $50,516.

Casting Stainless for Jets



POURING of stainless steel feeds into centrifugal spinning machine in jet engine ring-casting operation at Lebanon Steel Foundry. Centri-Die process was developed by Firth-Vickers Stainless Steels, England.



CASTING result is this ring shown being taken from mold after partial cooling. Heavy metal has been driven into mold by centrifugal force; material containing lighter slag and gas remains at bore of casting.

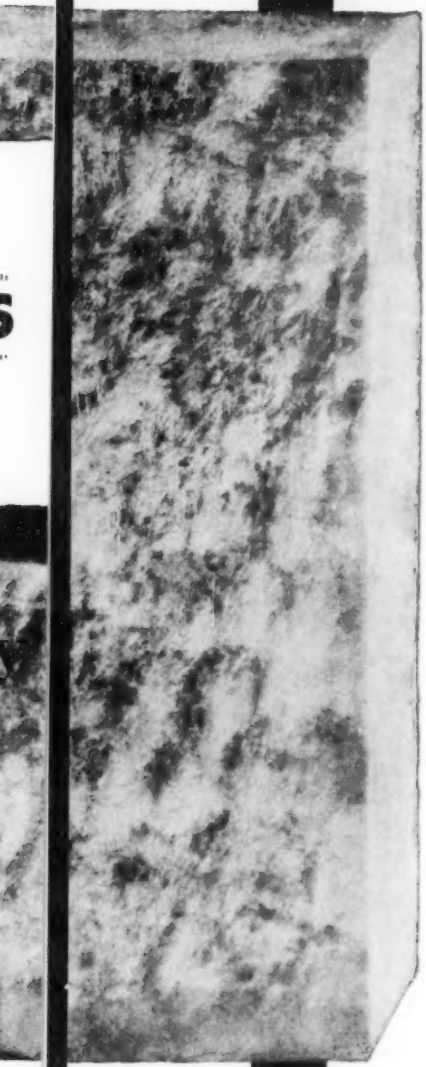
MACHINING of ring is preliminary step at Lebanon before shipment to Westinghouse, where it will be sliced into widths needed for J40 engine. Applications include turbine housing, nozzle support and blade spacer rings, diffuser and flanges.

FIBER PPG GLASS

Now!

Pittsburgh Plate Glass Company makes FIBER GLASS

On October 1, 1952, Pittsburgh Plate Glass Company began the production of Fiber Glass at its new plant at Shelbyville, Indiana. All of the technological and mass production experience acquired in forty-nine years of glassmaking are being devoted to the volume manufacture and further development of this wonder fiber . . . to assist in its greater utilization by industry.



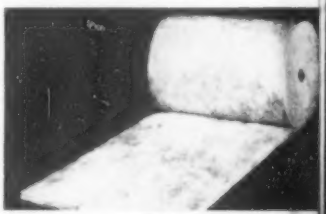
Highlights

OF THIS NEWEST FIBER GLASS OPERATION

PLANT LOCATION—Shelbyville, 27 miles Southeast of Indianapolis, is served by the Pennsylvania and New York Central railroads. The location presents numerous advantages to many users of Fiber Glass.

PRODUCTION FACILITIES—The most advanced manufacturing processes and techniques are being employed to assure the production of Fiber Glass which meets the most exacting standards and requirements.

PRODUCTS—Two basic forms of Fiber Glass, each in a full range of grades and sizes, are being produced:



SUPERFINE INSULATION—Composed of fibers of exceptional fineness—from 3 to 20/100,000 of an inch in diameter—providing greatest thermal and acoustical insulating efficiency-to-weight ratios, extraordinary strength, compressibility and resiliency. In all standard grades and sizes, or fabricated to specifications.

YARNS, STRANDS AND ROVING—Continuous filament fiber, twisted and plied to provide yarns of the weights and types required for electrical insulation and industrial and decorative fabrics. Roving, composed of continuous filament strands, bundled in parallel, and chopped strands, consisting of roving cut to lengths of ½" to 2", for use in plastics.

TECHNICAL ASSISTANCE—A staff of trained engineers is available to lend technical assistance in utilizing PPG Fiber Glass to maximum advantage in all applications, particularly those involving new fabricating methods and products.

RESEARCH AND DEVELOPMENT—A program of continuing research and development is established for the purpose of giving users of PPG Fiber Glass every future advantage, from refinements in manufacture to benefits in utilization.

The Unique Properties of
***PPG FIBER GLASS** Help Make*
Products ***BETTER,***
SAFER, LIGHTER, STRONGER

You may be able to realize important advantages in using PPG Fiber Glass. For additional information, please contact Pittsburgh Plate Glass Company, Fiber Glass Division, 632 Duquesne Way, Pittsburgh 22, Pa. . . . or district sales offices in Chicago, Detroit, New York, Washington . . . or the nearest PPG Warehouse.

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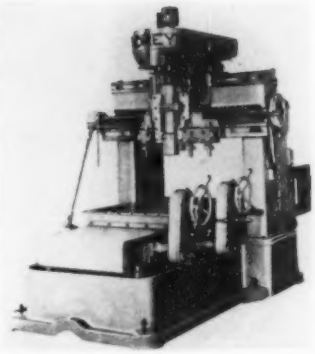

Mills Large Pieces

A new heavy-duty machine profiles and mills at high speed large forgings and castings that go into aircraft. Tool has rigidity and power to make heavy cuts into irregular steel forgings, with tungsten carbide tools.

The single spindle in this bridge-type unit is mounted in balance on a vibration-damped cross rail. Bridge columns may be raised on blocks to increase overhead clearance.

Milling can be controlled to close tolerances by operator with simple backlash take-up and control arms are adjustable to suit his convenience, manufacturer states. Profiler has both taper and straight follower holders. Supplied in table lengths up to 10 ft., the machine has centralized one-shot lubrication to cut maintenance. Morey Machinery Co., Inc., 410 Broome St., New York 12.

Willys Expands Aviation Work

Aviation activities of Willys-Overland Motors, Inc., have been extended to include fabrication of jet engine components, electronic equipment, landing gears, forgings, and airplane controls.

Here is how the firm's aviation work is spread among its plants:

• **Toledo.** Landing gears for Fairchild's C-119 Flying Boxcar and the Beech T-36 are produced here. The company's Electronics division in this city conducts research and development on aircraft controls and produces these units. Drop Forge division is also producing jet engine forgings.

• **Erie, Pa.** Aluminum Forge division has almost entirely converted to aircraft work—for Boeing, Martin, and General Motors.

• **Anderson, Ind.** Aircraft Engine division is producing component assemblies for General Electric's J47 jet engine.

Selected

for the LOCKHEED F-94

LEAR ELECTRO-MECHANICAL SYSTEMS were selected as important actuating devices on the Lockheed all-weather jet plane — the F-94C Starfire. LEAR Power units, flexible shafting, "T" drives, linear actuators, and screw-jacks make up the systems that actuate elevator trim tabs, aileron trim tabs, and wing flaps in the F-94C and other aircraft — from trainer to bomber, including the Lockheed F-80 and T-33.

The elevator trim tab system illustrated incorporates a LEAR Series 157 power unit, with capacity of 5½ inch pounds at 1520 rpm powering two LEAR Series No. 504 screw-jacks (rated 300 lbs.) through LEAR flexible shafting and "T" drives. Limit switches on the power unit control length of stroke of screw-jacks.

Lear electro-mechanical components are available for many actuating problems — and LEAR engineers will design necessary components and systems to solve your actuation problems.

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Electro-mechanical actuators, electronic temperature and positioning controls, servo systems • Pumps and radar proportioning equipment Autopilots and gyro instruments • Electric motors • Aircraft radio

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EASTERN
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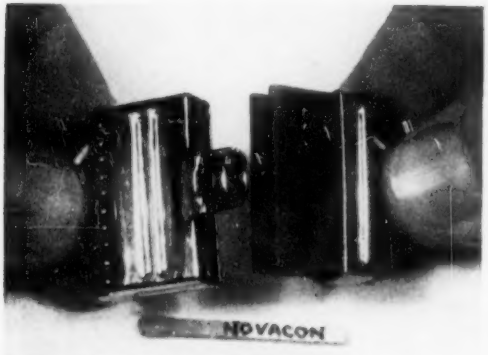
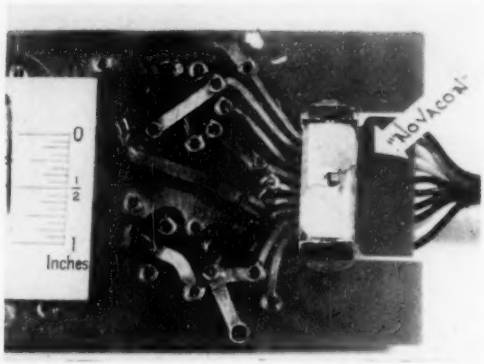
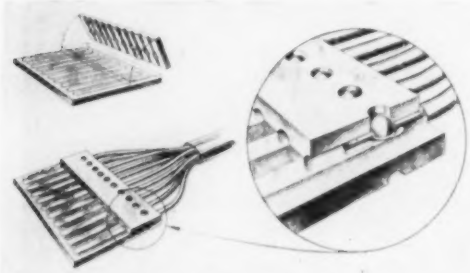


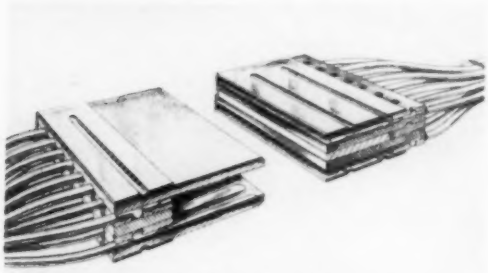
GE'S SMALL 20-conductor Novacon can be used . . .



TO CONNECT wires to printed circuits or other wires.



BASIC NOVACON 10-conductor elements like these are . . .



ASSEMBLED sandwich-style into male or female connectors.

Novel Connectors Aid Miniaturization

Tiny GE Novacon units may remove the last obstacle to automatic-factory assembly of printed circuits.

By Philip Klass

General Electric has applied printed circuit techniques in a new field to come up with a tiny connector for printed circuit and subminiature avionics equipment. The connector should eliminate a major remaining hand-labor operation which has until now stymied automatic-factory-type production of printed-circuit assemblies.

The new device, called the Novacon, was first disclosed by GE's Warren D. Novak in a paper delivered at the recent National Electronics Conference in Chicago. Based on audience reaction, and the flurry of inquiries at the GE exhibit, the Novacon connector was easily the hit of the conference.

▶ **Versatile**—The Novacon can be used to interconnect:

- Printed circuitry to printed circuitry.
- Printed circuitry to conventional wiring.
- Conventional wiring to conventional wiring.

GE has designed one version of the new connector so it can be constructed in a variety of sizes, both male and female types, from one basic 10-circuit element. By stocking these basic elements, GE or a purchaser would be able to assemble any desired size of connector (up to several hundred circuits), Novak said.

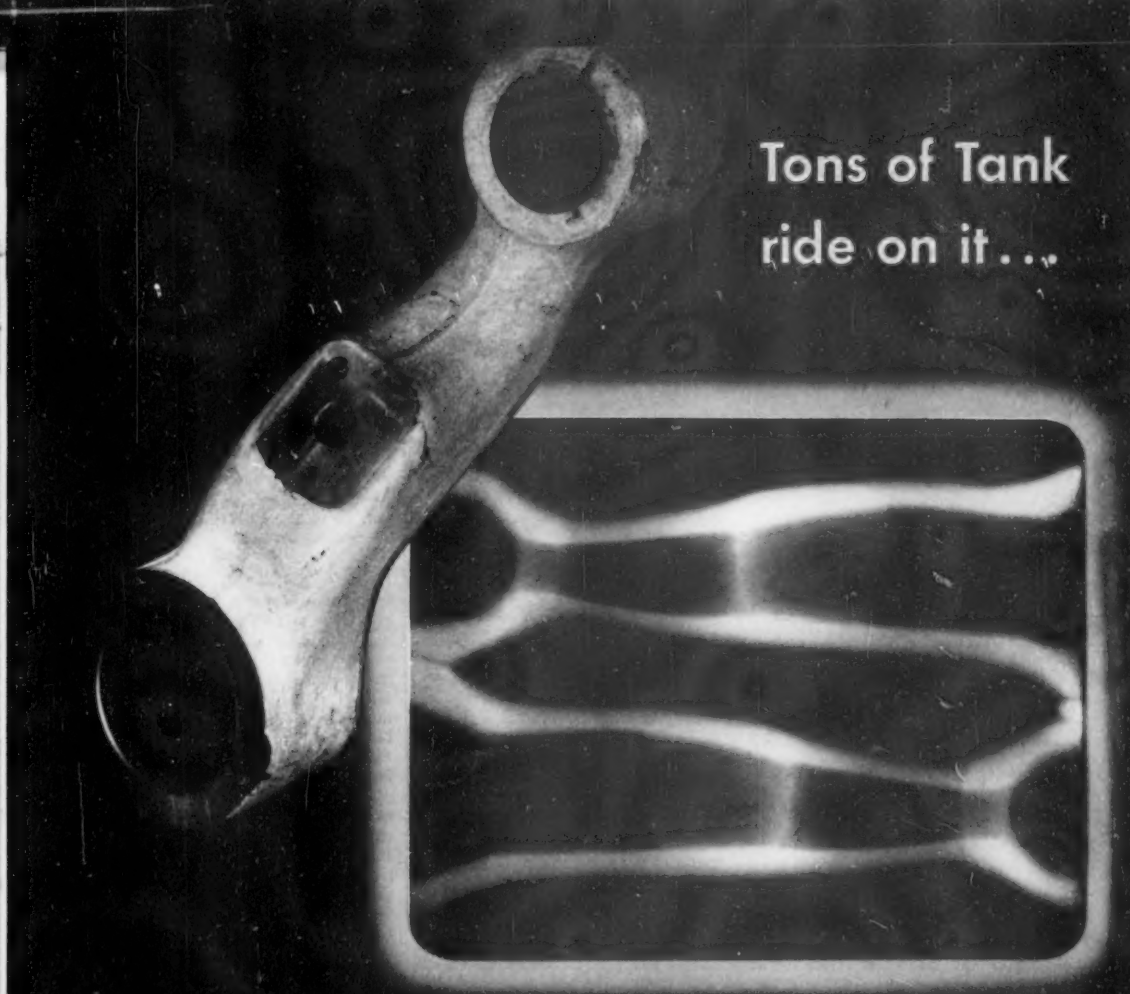
All the metal (shell) and the Textolite parts in plug have been designed for punch press operations to make the new GE connector easy and inexpensive to manufacture, according to Novak.

▶ **Basic Element**—The basic element is formed by bonding an insulating cover plate to a larger plate on which are printed 10 conductors. When used to interconnect printed circuitry to wires, the wires are inserted in lateral grooves milled in the cover plate (see sketch above—bottom row left).

To secure the wires to the basic element, a small slug of solder is placed in each of the 10 tiny vertical holes in the cover plate and melted either by soldering iron or induction heating. (The latter method is well suited to mass-production techniques.) The molten solder slides through the hole to bond electrically and to anchor the wire to the printed conductor.

Although solder is notoriously weak in tensile strength, any pull on the wires applies a shear stress to the solder, and in this it is considerably stronger.

▶ **Twenty-Circuit Novacon**—A 20-circuit wire-to-wire-type connector is constructed with two decks of 10-circuit basic elements in each of the male and female units. The connector is built up sandwich style and held together with a spring-steel compression band. A strip of silicone rubber insulates the



It's the arm that carries the rear caterpillar track wheel of a tank. Failure would mean complete disablement—so soundness in the casting is a "must."

To make sure, the casting is radiographed. It's the one way to learn internal conditions without destroying the part.

Cases like this show why radiography is becoming routine in foundries everywhere. It helps earn a reputation for constant top-quality work—frequently suggests changes in operations that bring higher yields in production runs.

Your x-ray dealer will be glad to discuss ways radiography can increase your production. Get in touch with him. Also send for a free copy of "Radiography As A Foundry Tool."

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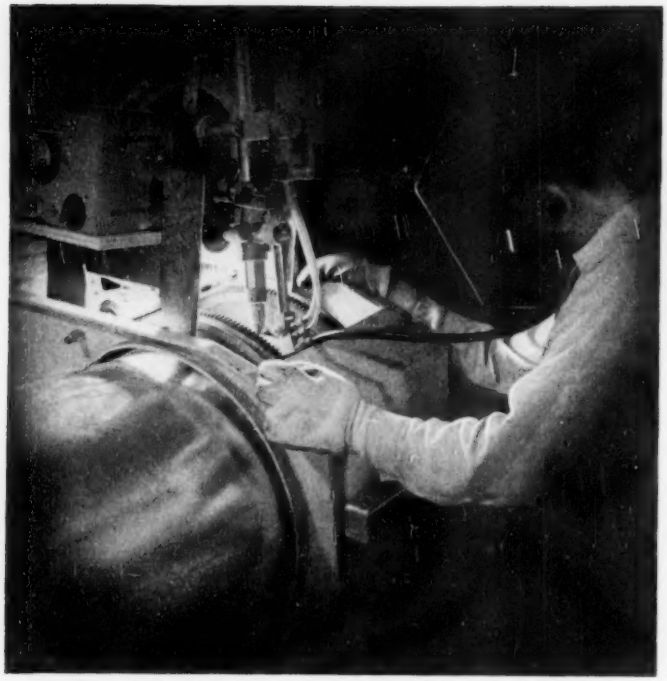

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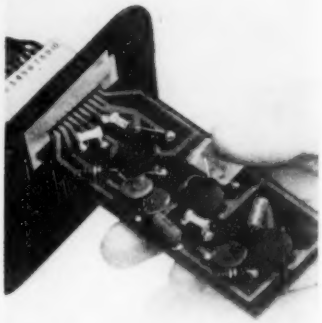

NOVACON can function both as an electrical connector and as a mechanical support for small printed circuit assembles like the one shown above.

two 10-circuit basic elements in the female assembly and also serves to exert contact pressure against the male assembly conductors.

A system of ridges and grooves in the compression bands secures the male and female units when mated. A small metal latch (shown in the photograph but not in the sketch) firmly locks the two units. Thumb pressure against the latch will raise it to permit separation of the two units.

▶ **Tests Show Ruggedness**—The 20-circuit push-together design was subjected to over 3,800 mating cycles before a single continuity failure occurred, Novak said. He added that more than 12,500 cycles did no physical damage to the connector. If the units were designed with a manually operated device to exert contact pressure after mating (zero separation force), Novak predicted that the plug could withstand hundreds of thousands of cycles before failure.

When GE conducted pull tests on the units, the solder anchor held firm and the wire broke *outside* the termination in every case, Novak said. Single wires sustained 17 to 20 lb. pull before breaking. GE clamped the connector in a pull-testing machine and tugged at all 10 wires simultaneously. The machine registered 175 to 200 lb. before all conductors broke, again outside their termination.

On the basis of these tests, Novak concludes that the present method of wire-to-connector termination will withstand any force which the wire itself can withstand.

▶ **Electrical Characteristics**—Novak said that tests on the basic 10-circuit element showed:

• **Contact resistance** of about 0.01 ohm or less for conductors ⅛ in. wide overlapping each other for a distance of ¼ in.
• **Voltage breakdown** occurs at 2,000 to

Prove to yourself...

These are better AN connectors--and at competitive prices

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...Because Monowatt *AN* Connectors have *all* these features:

- ***Moisture-proof seal.*** Two-piece inserts are joined with a silicone sealing compound. Moisture and condensation effectively excluded... parts held together while inserts are soldered to cable assemblies.
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- ***Fewer parts and simpler design*** make installation and inspection easy.
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- ***Available in complete wiring harness or cable assemblies.*** Made by Monowatt to your specifications.

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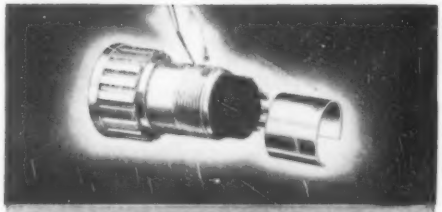
...Because the Monowatt Department of General Electric has complete modern facilities for mass-production, these features are offered at competitive prices.

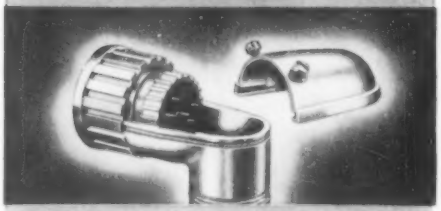
THE PROOF STARTS WITH THE QUOTATION

...*Prove to yourself* that Monowatt *AN* Connectors at competitive prices bring you extras—extras which save assembly time and insure a superior connecting job.



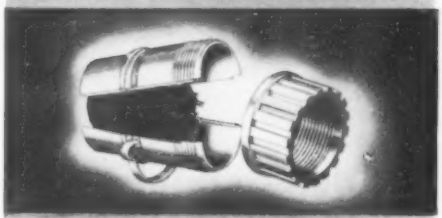
AN Solid Shell Connector

BETTER...because its snap-in retaining sleeve cannot work loose, yet can be released quickly with a screw driver and the insert removed for inspection or soldering.



AN Split-Shell 90° Angle Plug

BETTER...because top can be removed to inspect wiring without unmating or disassembling plug from conduit or cable. Conduit thread is not split. Split-shell ease of wiring is combined with advantages of solid shell construction.



AN Split-Shell Straight Plug

BETTER...because Monowatt engineers have succeeded in reducing number of metal parts and weight, while improving connector performance. This type is preferred where assembly must be made in tight places.

Send your specifications with this coupon. In return you'll receive a catalog describing the unique cost-saving features of Monowatt electrical connectors and wiring assemblies for aircraft, ordnance and electronic equipment — plus — quotations on your specific requirements. If you wish, a representative will call with sample connectors... all without cost or obligation.

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Monowatt Department G-11, General Electric Company
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☐ Please quote on the attached specifications and send catalog.

☐ Please quote on the attached specifications and have your representative call with sample connectors.

☐ Please send catalog only.

I understand neither the quotation, catalog nor call obligates me in any way.

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Street _____

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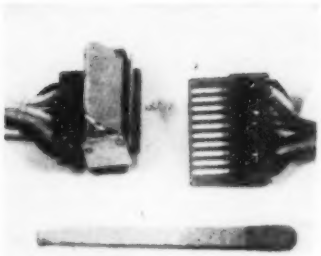
TEMPERATURE CONTROLS • BELLOWS ASSEMBLIES • BELLOWS DEVICES



SUBMINIATURE 10-conductor version of General Electric Novacon.

3,000 v. at sea level, at about 700 v. at 80,000-ft. altitude.

• **Insulation resistance** is 300 megohms to several thousand megohms at room temperature and humidity. This characteristic is solely a function of base laminate material and its condition, Novak said.

▶ **Wire-To-Printed-Circuit**—When the Novacon connector is used with a printed-circuit chassis, the chassis itself serves as the male element with its outgoing leads printed in a converging fan shape to align with the female connector conductors (see picture, p. 56).

When so used, slight dimensional variations of only a few ten-thousands of an inch in the chassis Textolite or conductor plating could result in poor contact pressure between one or several sets of mating conductors. A slightly different design approach in the female connector shell is needed to solve this problem.

GE has worked out several solutions, Novak says. One is to include a beryllium copper spring in the female connector shell which is actuated by two small manually operated toggle levers when the connector is installed on the chassis. The spring deflects the chassis slightly to create equal contact pressure on all conductors.

▶ **Connector Mount**—For some applications, Novak thinks the Novacon can be used as both a physical support and the electrical connector for small lightweight printed circuit chassis. For computers and other equipments which use vast arrays of electronics assemblies, this would make possible instantaneous replacement of faulty units.

GE has made hermetically sealed termination versions of its Novacon by soldering incoming wires to small copper tubes. These are in turn soldered to the basic element, and sealed off with a resin, Novak said.

▶ **Smaller Units**—Not content with its miniature connector, GE has experimentally made a subminiature 10-circuit connector which is only $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{4}$ in. using the same fundamental Novacon connector techniques. By using a two-deck construction with five conductors

For Copter Maintenance

Tightening capscrews attaching pitch horn to main rotor assembly.

Adjusting tail rotor linkage, ferret ratchet and open end wrench.

Tightening tail rotor shaft lock nuts, combination and open end wrench.

Snap-on* Tools

SOUND MAINTENANCE is a basic reason for the outstanding record held by Helicopter Air Service, Inc. Linking Chicago's airport with the main post office and 50 others in the area, on a 3-times-a-day schedule, from 6 to 36 hours are saved on deliveries. 3,000,000 pounds of mail are carried annually. In the past two years the fleet of eight Bell-47-Ds have made 40,000 take-offs and landings at the main post office alone.

Beyond the rigid requirements of routine maintenance, each ship after 300 hours is completely torn down and rebuilt. Half the personnel of Helicopter Air Service are the specially trained mechanics engaged in these operations. And you'll find them working with *Snap-on Tools* . . . the top choice of skilled mechanics everywhere in aviation. Snap-on factory branch warehouses offer direct service to aviation in all important centers. Write for complete 104-page catalog of more than 4,000 Snap-on hand and bench tools

Tightening starter retaining nut on 200 H.P. Franklin engine.

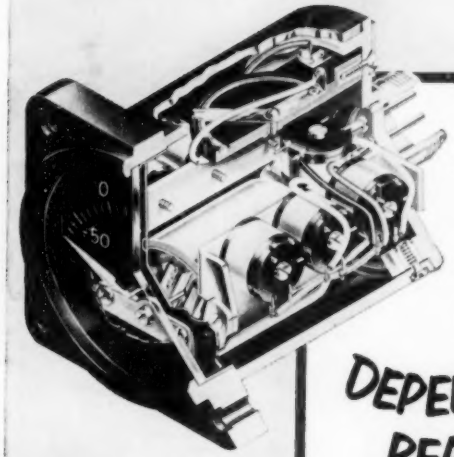
SNAP-ON TOOLS CORPORATION
8020-K 28th Avenue, Kenosha, Wisconsin

*Snap-on is the tradepark of Snap-on Tools Corporation.

Tensioning gimbal ring retaining screws, main rotor hub assembly.

EDISON

Temperature Indicators Selected for the New TWA "1049" Constellations



...for 5 DEPENDABLE REASONS

Cutaway illustration showing the construction of a small, single dial Edison Temperature Indicator—one of four Edison Temperature Indicators chosen for the new Model 1049 Constellation. Here . . . again . . . Edison instruments were the choice because of these five exclusive features.

For complete information on Edison dependable instruments, write for free bulletin AW-3023.

1. MINIMUM WEIGHT

Small Single Indicator, 0.5 lb.; Large Single Indicator, 0.7 lb.; Dual Indicator, 1.0 lb.; Triple Indicator, 1.3 lbs.

2. LESS MAGNETIC INTERFERENCE

Edison Indicators have no large stationary magnet to cause interference with the ship's compass or other equipment.

3. RUGGED DEPENDABILITY

There are no hairsprings and no delicate moving coils. The only moving part is a steel shaft carrying a tiny magnet and pointer.

4. EASY TO READ

Temperature increments have the greatest spread in the center of the dial where readability counts most.

5. INTERCHANGEABLE PARTS

Parts between indicators of different ranges are interchangeable. Changing from one range to another is accomplished merely by switching resistors.

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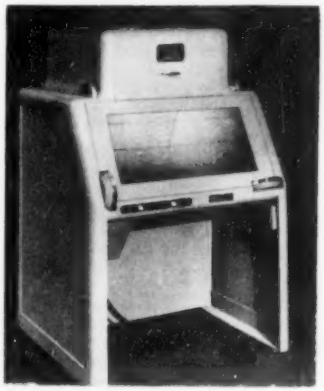
YOU CAN ALWAYS RELY ON EDISON

in each deck, Novak said that GE had built a 10-conductor unit only $\frac{1}{4} \times \frac{1}{4} \times \frac{1}{2}$ in. in size.

▶ **Future Plans**—For the present, GE doesn't plan to market a standard line of Novacon connectors, R. J. Biele of GE's Electronics Division told AVIATION WEEK. Instead, GE will accept orders for units tailored to individual customers' needs until it learns enough about what sizes, shapes, and styles are most in demand.

Meanwhile GE has lots of ideas for applying the Novacon principles to connectors of other shapes, i.e. cylindrical, disk, etc., with a variety of clamps and compression devices. It will probably experiment with new and improved base laminates to increase breakdown voltage and improve humidity performance.

Inquiries about the Novacon may be directed to R. J. Biele, manager-engineering of the components department, Electronics Division, General Electric Co., Syracuse, N. Y.



New Telereader for Oscillograph Films

Test data on oscillograph films can be read quickly and accurately with this new Universal Telereader developed by Telecomputing Corp., company says. Device will project oscillograms onto viewing screen with magnification of 2X, 4X, or 11X as required. A motor drive, controllable from a foot pedal, reels the oscillogram past the screen.

To read oscillogram, operator rotates two handwheels to position vertical and horizontal crosshairs on oscillogram trace being read. Position of crosshairs can be read from the dials, or can be printed in decimal form on a typewriter or punched on cards, when companion units are used.

Device will handle 16-mm. and 35-mm. film as well as film or paper oscillograms up to 12 in. wide and 100 ft. long. (Telecomputing Corp., 133 East Santa Anita Ave., Burbank, Calif.)

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Considering silicone rubber for parts or equipment?

General Electric silicone rubber is now available in many new forms—forms which greatly increase your design possibilities. You're familiar with conventional molded and extruded parts fabricated from G-E silicone rubber, but do you know that silicone rubber is now being fabricated in the following forms?

conveyor belting	**sponged products**
ducting and hose	**coated cloths and tapes**
wire and cable	**bonded parts**

Proof? Note the variety of forms of G-E silicone rubber in the photograph!

Here are other important facts. G-E silicone rubber . . .

remains flexible from —100 F to 500 F . . .
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is 3 times stronger than early varieties . . .
does jobs no other rubber can do.

New free booklet available! If you haven't investigated G-E silicone rubber *lately*, why not get up-to-date details? Mail the coupon below. You will receive a newly printed, informative booklet describing the amazing properties of G-E silicone rubber and telling how you can put them to work. It's free. Just send the coupon.

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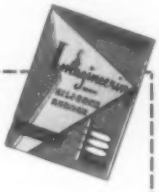

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Waterford, New York

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( ) Sponged products ( ) Hose and ducting

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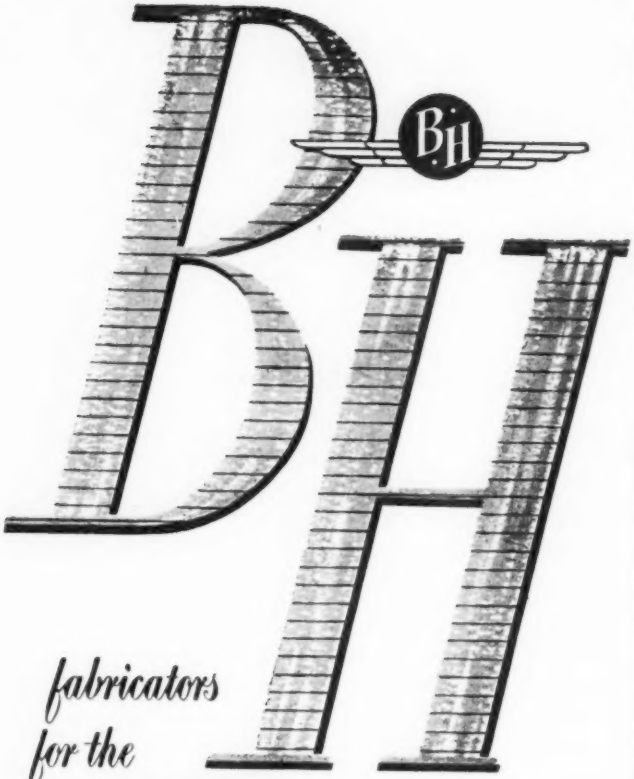

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FILTER CENTER

▶ **Production at 700%**—"Production of military electronic items is now at a rate seven times that at the outbreak of the Korean War; all but 5% of these items are of new and improved design," E. W. Engstrom, vice-president of RCA's laboratories told a luncheon audience at the recent National Electronics Conference in Chicago.

▶ **Cutting Waveguide Weight**—Bogart Mfg. Co. of Brooklyn has successfully fabricated an experimental S-band radar waveguide of aluminum, cutting its weight to ¼ that of conventional brass waveguides. Aluminum has been used in small X-band and K-band "plumbing," but making larger S-band waveguides of aluminum has posed fabrication problems. Use of aluminum plumbing in an airborne S-band radar could save 30 lb., Bogart thinks.

▶ **New Storage Tube**—Hughes Aircraft is reported to be developing a direct-view storage-type cathode ray tube, operationally similar to RCA's Graphechon. The new tube will presumably be used in a new Hughes interceptor fire control system.

▶ **New Thermistor**—A completely (glass) sealed high resistance thermistor with a −7% per degree temperature coefficient at 0 deg. Centigrade is now available from Victory Engineering Corp. Resistance of the new type 71A2 is 60 megohms at zero temperature, dropping to 3 megohms at 50C. (Springfield Road, Union, N. J.)

▶ **J47-23 to Use M-H Control**—General Electric has reportedly ordered a Minneapolis-Honeywell temperature override control for use with GE's J47-23 engine. The M-H control will tie in with GE's integrated avionic engine control system used with many of its powerplants.

▶ **Trainer Gets Zero Reader**—Evidence of growing USAF acceptance of flight director type instruments is the addition of Sperry's Zero Reader to Link Aviation's latest version of its C-11 basic jet flight trainer.

▶ **NEC Attendance Up**—More than 6,000 persons attended the recent National Electronics Conference in Chicago, a 50% increase over last year's attendance. All 97 technical papers presented will be published by NEC in a volume which will be available after Jan. 15, 1953. It may be ordered from Karl Kramer, Exec. Secy., NEC, 852 East 83rd St., Chicago 19, Ill. Price is $5.00.

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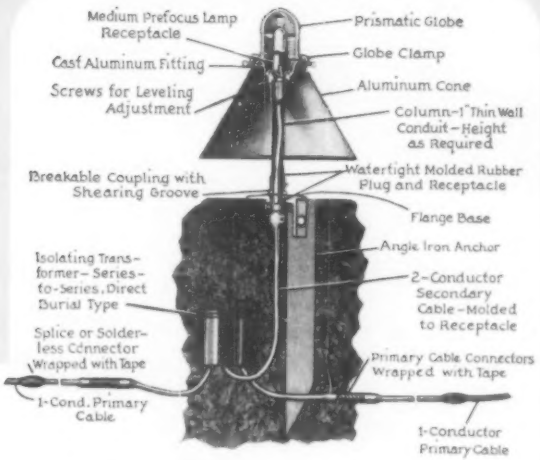
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Screws for Leveling Adjustment
Breakable Coupling with Shearing Groove
Isolating Transformer–Series-to-Series, Direct Burial Type
Splice or Solderless Connector Wrapped with Tape
1-Cond. Primary Cable
Prismatic Globe
Globe Clamp
Aluminum Cone
Column–1" Thin Wall Conduit–Height as Required
Watertight Molded Rubber Plug and Receptacle
Flange Base
Angle Iron Anchor
2-Conductor Secondary Cable–Molded to Receptacle
Primary Cable Connectors Wrapped with Tape
1-Conductor Primary Cable

Crouse-Hinds Type ERL Elevated Marker Light with Transformer Housing

Style A Mounting, as illustrated above, consists of surface flange and 30-inch ancher stake, with a direct earth burial type transformer. This provides the simplest and most economical installation.

Style B Mounting is illustrated in the assembled view at the left. It consists of a base plate and gasket to fit transformer base housings. It is used for converting existing flush marker light fixtures to ERL fixtures or for new installations at large airports or wherever a first-class wiring installation is desired. This mounting provides maximum accessibility of the transformers and connections and will save considerable time in case of wiring difficulties.

Style C Mounting is for multiple circuits and consists of a junction box with a hub cover on top, two squeeze connectors for through-feed cables at the bottom, and a 30-inch angle iron anchor. This mounting is especially useful for short runways and for taxiway lighting.

Style D Mounting consists of an integral cast Feraloy base housing and transformer complete with anchor stake. This transformer base in furnished in both series type (for 6.6-ampere circuit) and multiple type (for 600-volt multiple circuit).

Crouse-Hinds Elevated Marker Light is built to meet CAA Specification L-802. It can be furnished in any height from 17 to 30 inches, as required for local conditions. Either symmetric or asymmetric light distribution can be furnished. The globe is clear for runway lights, green for threshold lights, or blue for taxi lights. A breakable aluminum coupling is at the bottom of the mounting column. It is designed to withstand high winds and propeller blasts but will break readily upon impact.

This marker light is one of the hundreds of items in Crouse-Hinds complete line of airport lighting and control equipment. Write for full details on the equipment you require, whether it is a single unit or a complete airport installation.

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CHAMPION PLAYS HOST at three-day Toledo meeting where more than 100 aviation ignition specialists gather to hear . . .

Plug Problems Analyzed by Conference

- **Specialists at Champion meeting find that ignition systems become more reliable; but still see bugs.**
- **Agree on worth of analyzers; split on value of TCP, use of two different plugs in same engine.**

By George L. Christian

Toledo—Aircraft spark plugs and ignition systems are becoming more reliable.

Spark plug life is lengthening—actual removal rates of 400-600 hours are being successfully maintained by some carriers. And at least two airlines reported number of unscheduled plug removals as "negligible."

Ignition systems are generally becoming more trouble-free. (A few bugs have emerged in some Scintilla low-tension units, but Scintilla reports it is rapidly correcting these malfunctions.)

Increasing use of analyzers—Sperry's engine and Scintilla's ignition instruments—are helping civilian and military aircraft operators finger ignition troubles and correct them before they become serious.

▶ **Wide Interest**—But plugs and ignition systems still pose enough problems so that over 100 specialists were kept busy for three days at Champion's recent Spark Plug and Ignition Conference here. The specialists represented over 30 airlines—some 20 domestic and ten foreign—USAF, BuAer, the Civil Aeronautics Administration, petroleum companies, and industries associated with the topics discussed at the meetings.

The industry representatives came from du Pont (anti-detonants), Vapor Blast (spark plug cleaning machines), Sperry and Scintilla (analyzers), Packard Electric, Breeze, and Titeflex (ignition manifolds and leads), and Pratt & Whitney Aircraft, Wright Aero, Westinghouse, General Electric and Allison (engines).

Airline representatives to the Toledo conference came from such distant carriers as Argentine Airlines, South African Airways and Philippine Air Lines.

▶ **Highlights**—Here are some of the things the conference heard:

• **Eastern Air Lines,** unhappy about splitting and "banana peeling" of Champion's R37S-1 plug's center electrodes, is testing approximately 15 sets of AC's 171 plug in all engines it operates, except DC-3 powerplants. Test should be completed by December. F. W. Lochner, EAL's general foreman, engine accessories, told the meeting the AC171s "were comparable to the R-37S-1, without trouble," so far. But the carrier is having trouble getting delivery on AC's plugs.

• **TCP debate** showed wide divergence of opinion concerning the worth of the anti-plug fouling ingredient (tricresyl phosphate). Navy said that on some of its P&WA R2800 engines, plug fouling had been cut 90%, thus increasing aircraft availability 20-23%. American Airlines has completed one test evaluation of TCP, and will shortly start another. Northwest Airlines abandoned a Boeing Stratocruiser (fleet-wide) test because of turbosupercharger nozzle box trouble.

• **Temperature differential** between front and rear position spark plugs (and between front and rear row cylinders of the R2800 engine) brought repeated demands from Chicago & Southern's superintendent of engineering, R. L. "Doc" Anderson, that Pratt & Whitney Aircraft do something to better the situation.

• **Use of two different plugs** in the same engine was condemned by some airlines having such an installation. Two different plugs are used by most R2800 operators because of temperature differences between front and rear positions.

• **P&WA** said they had observed (on analyzers) as many as 15-16 plugs cutting out simultaneously at takeoff powers. This condition was largely corrected by use of TCP in the fuel, however.

• **Champion engineers** have measured a 1,000F temperature rise in 30 seconds on plugs going from idle to maximum power conditions.

• **Number of power setting changes** required of an engine is an important factor in plug fouling, Champion found. Deposits are mostly laid down during cruise settings.

• **Worthwhileness of cleaning** spark plugs aroused controversy. Cost and complexity of machines was frightening to some operators, who favored the idea of having a half-engine-run plug and discarding it. Other operators (and the USAF) wanted to clean plugs. Most of these do not discriminate between new and used plugs when installing them in engines.

• **Vapor Blast Manufacturing Co.** emerged as a promising source of plug cleaning machines. Champion's cleaning methods were praised by the airlines using them. Packard Electric is

th[illegible] won't Skid

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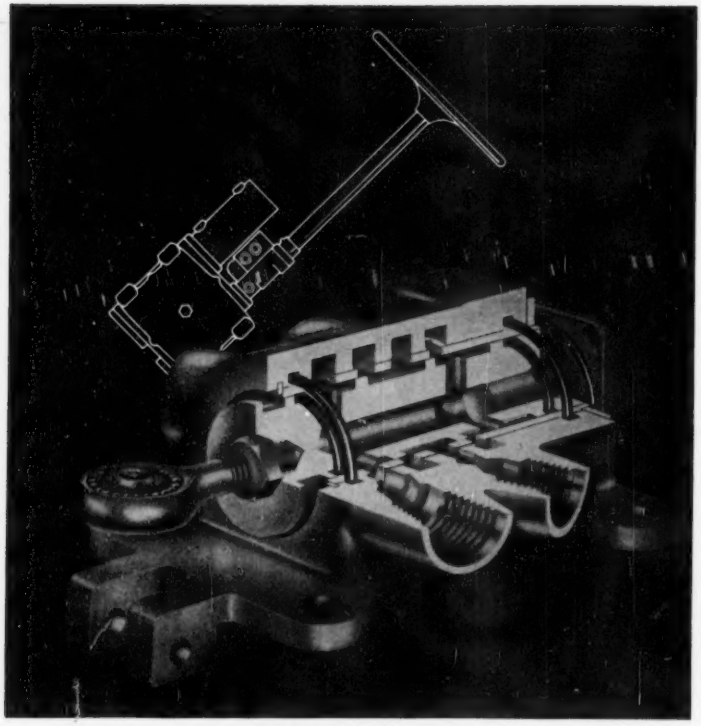

Cutaway view showing PARKER O-rings in control valve of Ross Hydropower Steering Gear.

PARKER O-RINGS . . . for Simplified Sealing

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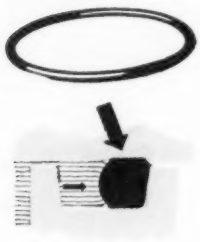

Cross section drawing of O-ring in groove, sealing under pressure.

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working on a chemical plug cleaning system.

• **High-energy ignition systems** will not be used on reciprocating engines for some time because they are not competitive with existing ignition systems. Current high-energy systems have undesirable erosion rates.

• **Plugs should be packaged** 50 at a time, an airline poll showed. Overseas carriers put in their bid for military-type, tin-can packaging with silica gel moisture control to preserve plugs under adverse climatic conditions.

Jet Ignition

USAF said that the average life of jet igniter plug on B-36s is 50-70 hr. Short life is not the plug's fault, but is attributed to B-36 operating conditions.

On F-84s, plugs are cleaned at 50 hours, removed at 100 hours. Only new plugs are installed in the engine.

Air Force said destruction of jet plugs is caused by engine heat, not by sparking. Jet plugs are highly reliable—this is underlined by the fact that only one UR (Unsatisfactory Report) has been issued against them this year. Service life of jet plugs is not long enough to warrant reconditioning them.

British Overseas Airways Corp., sole commercial jet engine operator, said that the only problems it was having with igniter plugs is erosion and distortion. The former is believed to be caused by the latter.

Flameout is no longer a serious aspect of jet engine operation, says the USAF. For instance, in 15,000 flying hours rolled up by F-84s in Texas, only three flameouts were reported. And flameouts on B-36s are negligible. Most flameouts are due to military-type operations and should cause commercial jet operators no worry. Major reason for improved flameout situation is better design and operation of fuel control mechanisms, USAF believes.

Plug Test & Reconditioning

Champion's liquid cleaning unit gets plugs cleaner than sandblasting, most airlines agreed. TWA and American gave production capacity of the unit as 40-60 units an hour, including loading and unloading time. They said the machines worked well and did an excellent job, nozzle design is good, permitting cleaner to get under ground electrodes, but nozzles should be cleaned regularly. R. K. Christie, Champion's director of research, offered to send complete blue prints of the machine to anyone who asked for them.

Those using sandblasting said the best air pressure is 85-100 psi.

A silica-free garnet, said to give good

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DOUBLE RIVITORS
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Set two rivets at a time with this new T-J Dual Rivitor! This machine is equipped with 10" hoppers, and tooled to automatically feed and set two ⅛" dia. x ½" long wagon box head rivets at a time in elevator chain and saddle or elevator flight assemblies for farm implements. Controlled by one foot pedal.
CLINCHORS
Set two nuts at once with the new T-J Double Clinchor! This machine is tooled to feed and set ⅜" x ⅓" x 1/16" thick Fabri-Steel nuts at each operation. Both Clinchors are tripped by the same foot-operated valve. Adaptable to a wide range of clinch nut setting problems.

Save labor . . . speed up production with T-J Rivitors and Clinchors adaptable to a wide range of assembly jobs today . . . in aircraft, automotive, farm machinery, stampings of all kinds!

T-J Clinchors set clinch nuts 3 to 5 times faster! Fully automatic . . . controlled by a single foot pedal. Available in Underfeed and Gravity feed models, throat depths 8" to 36".

T-J Rivitors automatically feed and set solid rivets . . . with high production! Electrically-powered Rivitor sets 1/16" to ¼" diam. solid steel rivets up to ⅞" long. Air-powered Rivitor sets aluminum alloy rivets up to ¼" diam. or steel rivets up to 1/8" diam. and up to ¾" long. Throat depths 8" to 36"

Write for Clinchor bulletin 847; Rivitor bulletins 646 and 847. The Tomkins-Johnson Company, Jackson, Mich.

T-J Rivitor used for automotive clutch plate assembly. Saves time and labor doing a four-fold job—assembling, setting, inspecting and ejecting.

36 YEARS EXPERIENCE T-J TOMKINS-JOHNSON

Spark Plug Fouling Details

Spark Plug Fouling and Pre-Ignition Characteristics of Aircraft Engine Corrosion Preventive Compounds

Type of Test	Tested Materials: Aircraft Engine Oil MIL-0-6082	No-Rust Oil Non-Metallic Type MIL-C-6529 (USAF) MIL-C-7853	No-Rust Oil Metallic Type AN-VV-C-576
Spark Plug Fouling (Hours)	63 (a)	45 (a)	14 (b)
Pre-Ignition (Hours) (c)	None	None	36
Cleanliness (Av. piston skirt deposit) (d)	2.5	4.5	3
Corrosion Protection Humidity Cabinet (Hours) (e)	2	430	48
Hydro-Bromic Acid	Fail	Pass	Fail

(a) Average of four tests in 2 two-cycle engines.
(b) Average of eight tests in 2 two-cycle engines.
(c) Four cyclinder Continental test engine on 50 hours preignition procedure (100 R.P.M. drop equivalent to mild preignition).
(d) Gulf rating system. Rating of 10 is perfect, 0 is bad.
(e) Average of 10 panels. (Qualification test requires 144 and 360 hours with polished panels).
(AN-VV-C-576 only requires 150 hours on sand blasted panels).

Source: Gulf Oil Corp.

cleaning results, was introduced to the conference. Producer is the Florida Ore Processing Co., 9 S. Clinton St., Chicago 6, Ill. Spec number of the garnet is CSP75A.

AC has changed to a garnet-type abrasive and says it gets better results.

▶ **Vapor Blast**—A Navy Vapor Blast plug cleaning machine incorporates these features:

- **High and low pressure** blasts on the plug.
- **Automatic indexing,** to position the plug correctly for each cleaning operation.
- **Automatically rotating table** so that cleaning jets impinge on all sides of the plug.
- **Average cleaning time** of 5-10 seconds per plug.

After cleaning, plugs are rinsed to clean off abrasive.

Vapor Blast was given the assignment to come up with an improved cleaning machine to be worked out in cooperation with Champion. The company will add these features to the existing piece of equipment:

- **Capacity and fixtures** to process two plugs simultaneously.
- **Pressurized delivery** of slurry to guns.

Additional items to be considered, probably as auxiliary equipment, will be power spray rinse, air blowoff, various abrasives (including new ones) and possible chemical additives to the slurry to improve cleaning action.

Vapor Blast showed the conference preliminary drawings of a machine that would clean twice as many plugs as the Champion job and which was tentatively priced at $900.

A spokesman from Kelly AFB, "the world's largest air depot," said Kelly cleans 20,000-25,000 plugs a day on three shifts. Daily savings were estimated at $30,000.

▶ **Worth It?**—Ray Farren of Trans-Canada Air Lines posed the $64 question: Is plug cleaning really worth it? By the time you consider all the added handling needed for cleaning and pay for the labor and machinery required by the cleaning process, he doubts it. Farren says TCA runs its $3 Lodge plugs 500 hours in Merlin engines and throws them away, with good economic justification. By installing only new plugs, you get uniformity of performance, Farren says.

KLM Royal Dutch Airlines continues its own system—re-gapping, not cleaning, of spark plugs. The carrier does not use a plug for more than two runs—equivalent to about 1,500 hours.

American's senior engineer, Paul Kovac, gave this account of his company's experience with installing only new plugs in engines: On P&WA's recommendation, AA installed only new plugs (Champions) in the engines of its 17 new DC-6Bs and changed them every 200 hours. But maintenance personnel noted that these 17 aircraft experienced as much ignition trouble as the standard DC-6s and Convair 240s. AA reverted to pulling plugs at 400 hours and using reconditioned ones.

Trans World Airlines said that plugs used in its R2800-engines have the lowest unscheduled removal rate; the carrier uses new and overhauled plugs indiscriminately. United and Air France also do not discriminate between new and overhauled plugs.

The Air Force countered that on the B-36 only new plugs are used because with reconditioned plugs rejection rate is excessively high.

▶ **Bomb Testing**—TCA stated that it found results of standard bomb test were completely at variance with actual results of plugs operating in an engine. Possible reason for the discrepancy is heat in bomb test machine differs materially from heat in engine.

Air Force suggested that much time could be saved and realistic results obtained by eliminating bomb testing and using analyzers to judge plug performance after installation in the engine.

Al Yacavone of Pratt & Whitney said that his comany has used heated bomb testers satisfactorily. But although bomb tests do tell the condition of the plug, they are not equivalent to an analyzer check. But hot bomb testing is a long and tedious procedure, a deterrent to its use.

Plug Fouling

TCA's Farren pointed out that there are different types of plug fouling. For instance, BOAC and TCA fly over the same routes with the same types of aircraft but experience different types of plug fouling. He suggested that the variable might be engine operating standards, particularly different fuel/air ratios.

Champion said the number of power changes an engine is subjected to is an important criterion in plug fouling. Deposits are laid down mostly during cruise power conditions. And great temperature variations—1,000 deg. rise in 30 seconds can occur on plug core noses under an application of takeoff power.

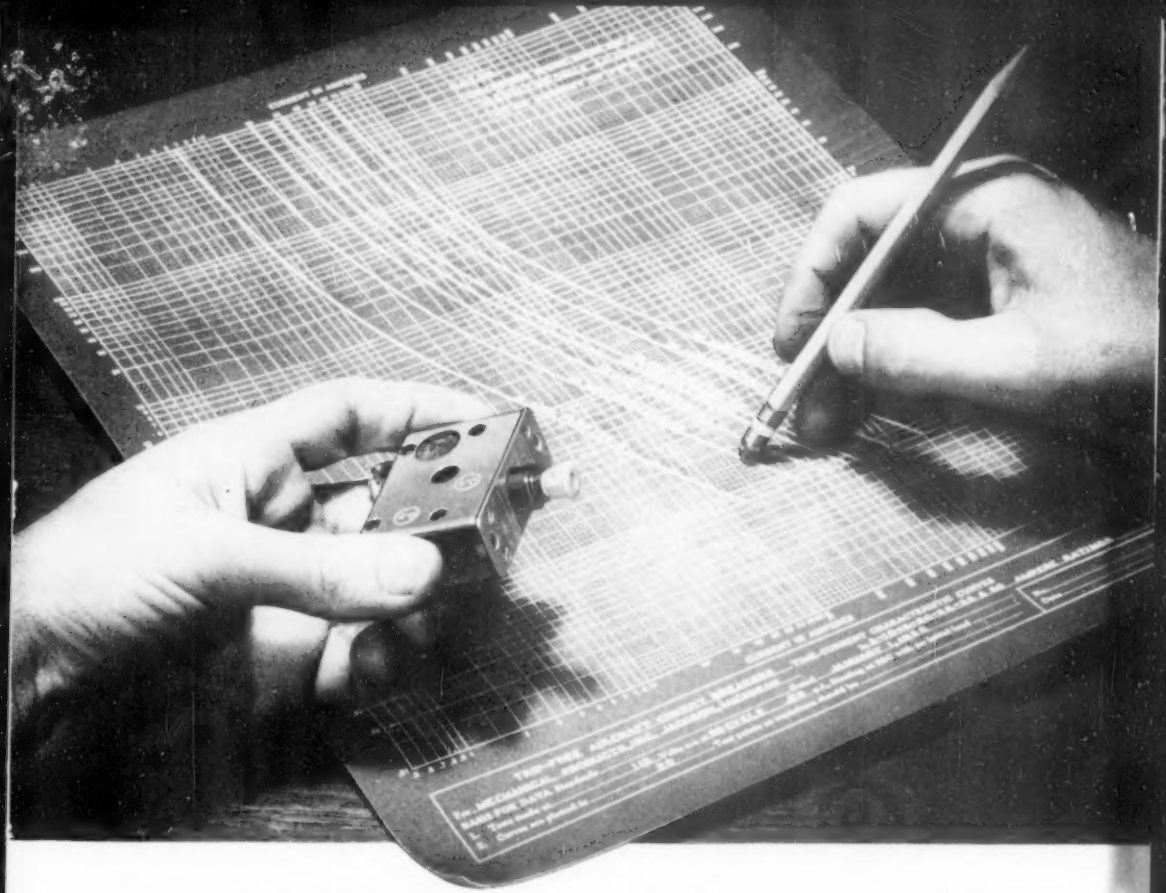
Champion listed these temperatures recorded on a thermocouple plug operating in a two-plug cylinder:

- Both plugs firing—820F.
- Thermocouple plug firing—760F.
- Non-thermocouple plug firing—540F.

The temperature drop on a non-firing plug is due to flame front coming from the other side of cylinder instead of originating on the plug nose.

Fuels, Additives & Lubricants

Gulf Oil Corp. representatives talked of their company's development of non-metallic rust-preventive engine oils which do not contribute to plug fouling. Old type of rust preventive oils,



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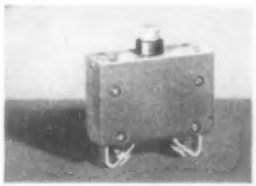

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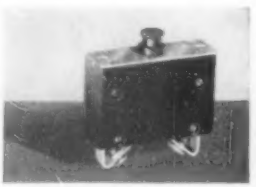

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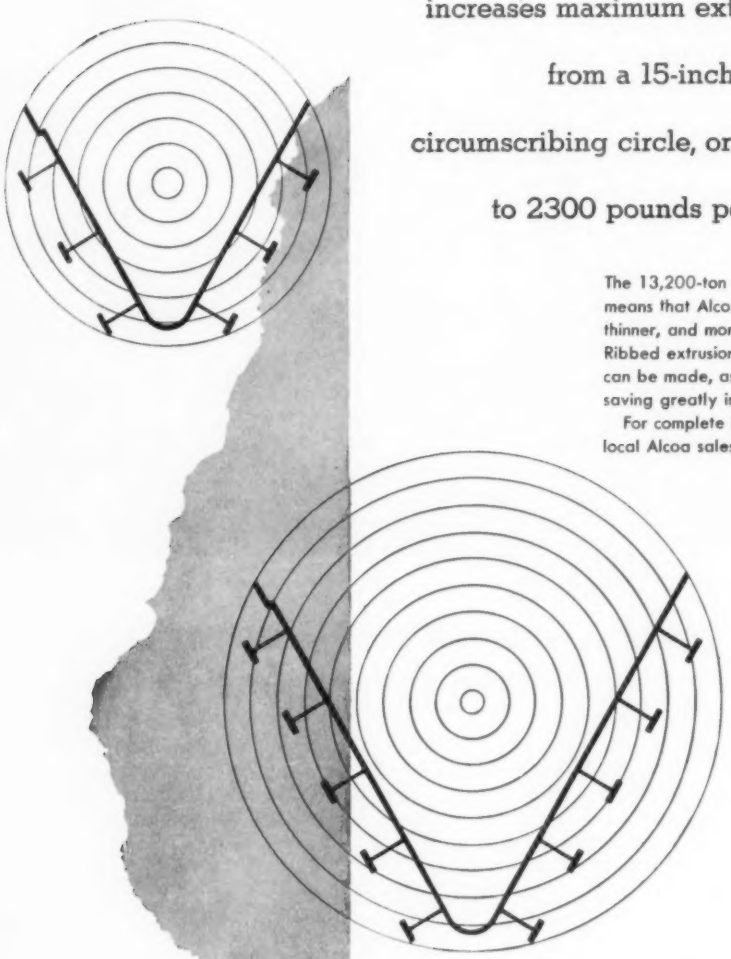

The 13,200-ton squeeze of this press means that Alcoa extrusions can be larger, thinner, and more intricate than before. Ribbed extrusions for panels, for example, can be made, as illustrated, 34 inches wide—saving greatly in riveting and assembly.

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specified as AN-VV-C-576 materials, contained metallic additives which helped cause plug fouling.

Gulf announced results of its tests comparing the new type of oils with the old 576 types.

- **Engine surfaces** are protected many times longer by the new oil.
- **Pre-ignition** is not promoted by new oil.
- **Plug-fouling possibilities** are considerably reduced by the new oil.
- **Plugs operate three times** as long on new oil as on the 576 material.

A 50-hour accelerated service test on three oils—standard aircraft engine oil (MIL-0-6082); no-rust oil, non-metallic type (MIL-C-6529 (USAF), MIL-C-7853); and no-rust oil, metallic type (AN-VV-C-576)—not only showed that the new oil did not cause pre-ignition, where the old type did in 36 hours, but that it produced an "engine that was somewhat cleaner."

▶ **TCP Test**—Great interest was shown in Shell Oil Co.'s anti-fouling additive, tricresyl phosphate (AVIATION WEEK Sept. 25, p. 44).

American announced that its first test with TCP showed no significant improvement in spark plug removal rate. The test was conducted for 1,400 hours on two DC-6s using 0.2 theory addition of TCP. But, as American pointed out, the plug removal rate on its —6s was already very low, and it was using relatively rich mixtures. The carrier stated that it was going to run a second test using 0.1 instead of 0.2 theory mix.

Here are some undesirable features American attributed to using 0.2 theory TCP mix:

- **Crown corrosion** showed on one-third of the exhaust valves on TCP engines.
- **Heavy deposits** were found on exhaust valve heads and seats and on the back part of ground plug electrodes.

Northwest Airlines had a TCP evaluation program going on its 10 Boeing Stratocruisers. But, in 150 hours of operation on TCP fuel, NWA flight crews noticed unexplainable increases in exhaust back pressure. Cause was soon found to be deposits clogging the turbosupercharger nozzle boxes. Use of TCP was immediately discontinued. Cause of deposits was laid to high temperatures at this point in the exhaust system.

Shell said the corrosion found on American's exhaust valves might be laid to high temperatures, since neither USAF R4360s nor Navy R2800s suffered corrosion problems (apparently Shell believes that American is operating its engines at higher temperatures than the military).

Other TCP highlights:

- **TWA is running a test** on all four engines of four Model 049 Connie coach aircraft. Four identical planes are being run without TCP fuel as a control. TCP aircraft have accumulated 11,000 engine hours, control ships 12,000. No significant difference in spark plug operation has been apparent to date, according to TWA. Unscheduled removal rate of TCP plugs is 2.0 per 1,000 hours. Corresponding rate for non-TCP plugs is 2.6.

P&WA stated that TCP is effective in eliminating plug fouling. In its tests it found that without TCP, as many as 15-16 plugs would go out at takeoff powers. With TCP, maximum number to go out was three, a fact to which P&WA attaches significance. American confirmed this by saying that its DC-6 flight engineers had noticed that TCP virtually eliminated plug misfiring during takeoff.

On 500 plugs removed from Navy FSFs, used with TCP, none had deposits. On non-TCP plugs removed from other FSFs, "many had deposits." D. H. Harris, shell senior engineer, stated that spark plugs removed for fouling from B-36s had been reduced by 70-90%. On Navy R2800 engines, he estimated the figure to be close to 90%, while on military helicopters the reduction stands at 60-85%.

The RCAF is testing TCP on its Merlins, but no results are available.

KLM is testing TCP on a Convair

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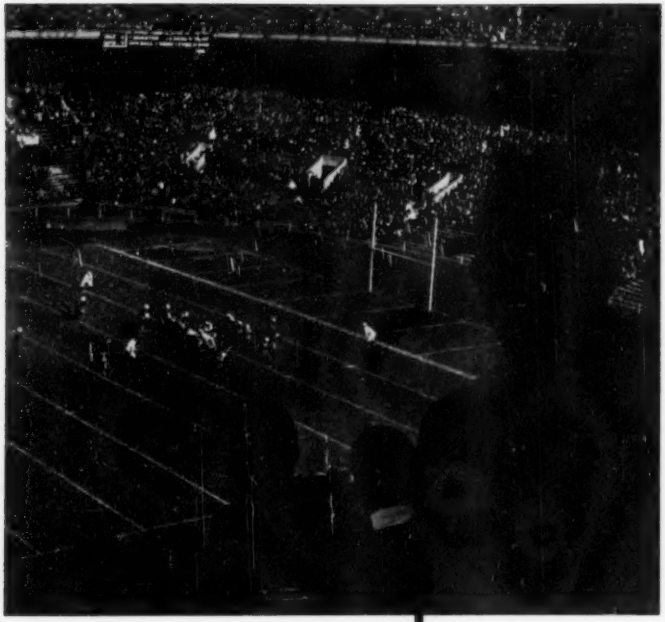


240. The first 600 hours were run with 0.2 theory mix, the next 600 hours with 0.1. KLM expects to expand TCP use to half its fleet of 240s.

Harris sees no immediate prospect of adding TCP to all aviation fuel. It has already been demonstrated that TCP mix fuel cannot be used in engines equipped with exhaust turbines. But, he said, TCP is available to all who want it.

Service Experience

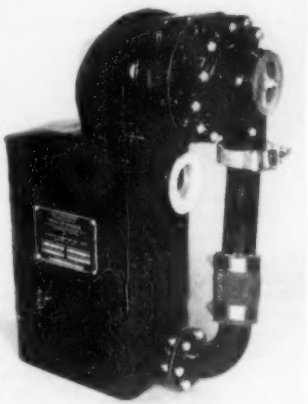
Champion recognized that users of its E change plug were experiencing trouble. The E change plug is the R37S-1 with a glass instead of what Champion calls a sillment seal.

The two major problems experienced were flareout ("banana peeling") and excessive erosion of the center electrode.

To correct the first complaint, Champion tightened control on every manufacturing and inspection operation involving the center electrode.

The company outlined this three-phase program to improve the glass seal plug which Champion no longer designates as the E change plug, but simply as the R37S-1:

• **Phase I:** Improve processes and



COOLS MYSTERE COCKPIT

Offshore procurement in reverse could describe recent order by French firm, Avions Marcel Dassault, for six of these U. S. Stratos cooling units for installation in the Mystere jet fighter. Cooler bleeds hot air at high pressure from plane's jet engine compressor and refrigerates by passing air through heat exchanger and expanding it through small turbine. Unit delivers 13 lb./min. air at a temperature of −0F., weighs 14 lb. It is similar to Stratos cockpit cooler in the McDonnell Banshee, but is called NUR12 by French. Made by Stratos div., Fairchild Engine & Airplane Corp., Farmingdale, N. Y.

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The failure of splined parts to assemble properly or to interchange, and the resulting high rate of scrap had been a constant worry for many months. So he called on Vinco. A careful check was made of how splined parts were designed, manufactured and gaged, then design improvements and a practical and efficient gaging program were recommended. This program was accepted. Now his splined parts are interchangeable, meet all specifications and scrap is at a minimum. We can do the same for you.

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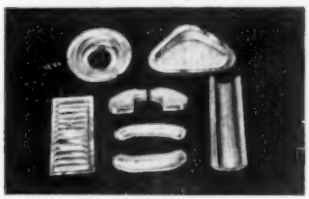
Rockets blast in a flash of fire from the U. S. Air Force's Northrop Scorpion F-89D during armament tests over the Southern California desert.

Thermoflex Thermal Insulation Blanket being applied to a jet engine exhaust cone. Special grooving assures precision fit around cylindrical and conical surfaces . . . allows for expansion at high temperature.



Typical preformed shapes of Thermoflex, custom-made to insulate the intricate and often irregular surfaces involved in many aircraft applications. *Reg. U. S. Pat. Off.

J-M Thermoflex Insulation *controls searing heat of twin jets*

The new F-89D Scorpion . . . rocket-blasting, twin-jet, all-weather interceptor manufactured for the Air Force by Northrop Aircraft, Inc. . . . is equipped with Thermoflex* High Temperature Thermal Insulation Blankets for aft-frame protection.

Thermoflex insulates the shaft housing of the F-89D's jet engine against searing heat . . . helps keep oil and bearing temperatures down to a safe level.

Thermoflex Blankets, standard protection on many Air Force and Navy jets, are custom-made. The insulation filler is made from highly stable Thermoflex RF Felt. This newly developed refractory fiber felt insulation is sealed between sheets of corrosion-resistant metal foils.

During manufacture, careful attention is given to the accuracy of cutouts for engine supports, actuator mountings, fuel lines, thermocouple leads and other controls. Edges at cutouts are sealed to prevent fuel penetration into the felt insulation filler. This precision fabrication of Thermoflex Blankets assures maximum insulation for the entire application.

In addition to insulation blankets for tail pipes, engine cones, turbine casings and afterburners . . . Thermoflex is also made in special preformed shapes to insulate, protect and fireproof fluid storage tanks air-conditioning systems, thermal de-icing ducts and many other assemblies in all types of aircraft.

For the complete story of Thermoflex Insulation for aircraft power plants and airframes, send for illustrated folder IN-136A. Address Johns-Manville, Box 60, New York 16, N.Y. In Canada, 199 Bay St., Toronto 1, Ont.

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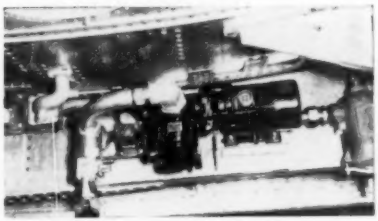
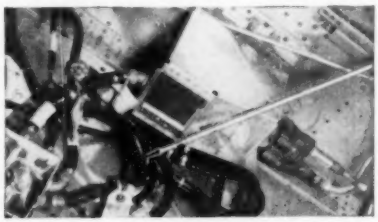
Precision-made, time-tested Pesco fuel pumps are only one of several Pesco products, including main and emergency hydraulic pumps, propeller feathering pumps, and cabin supercharger pump, specified by United Airlines as standard equipment on their new fleet of Mainliner Convairs. For complete information on these or other products, write or call today.



View shows the Pesco motor-driven fuel pump as mounted in the nacelle of a new Mainliner Convair.



Another Pesco product that is standard equipment on the new Mainliner Convair is this auxiliary hydraulic pump, located in the nose wheel of the plane.

engineering Pesco production

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methods of applying cement.

• **Phase II:** Use new method of firing glass seal. Plugs with this improvement will be available in November.

• **Phase III:** Substitute 521 alloy or Inconel as center electrode material.

Champion indicated that the R56S plug is being service-tested by P&WA for use in all positions of the R2800 engine. Its engineers expressed confidence that the plug would do well, especially when Phases II and III are incorporated.

Many airlines are using Champion R33S plugs in rear positions of the R2800 engine and find it satisfactory. The plug causes backfiring when used in all positions of the engine. But Eastern said it was too complicated to use two different plugs in one engine.

On the other hand, UAL, which specifies in which cylinders to use the R33S (2-4-6-14-16-18), says it has no problem having the correct plug installed in the correct position. But United wants better identification of plugs.

TWA is having trouble with R37S-1) ground electrodes fracturing.

Eastern indicated that it expected successful operation of the AC 171 plug. Tests should be complete by the end of the year.

▶**Fine or Massive?**—Air Force spokesmen said that they found very little difference in performance of fine-wire and massive-electrode spark plugs. KLM said gaps on fine-wire plugs tended to close with use. The carrier is using fuel with 4.6 and 4.7 cc. tetraethyl lead content. TCA said they had experienced bridging of fine-wire plugs and were going from a .020 to a .030-in. gap.

Sabena said in actual cost it was better off using BC (fine-wire) plugs than massive-electrode units in its aircraft flying in the Belgian Congo.

United and Western Airlines have been conducting tests to determine if 25-deg. spark advance has any detrimental effect on R2800 engine. Both carriers concur that spark advance had no measurable effect on engine parts. Fuel economy attributed to spark advance was set at 1½%.

Life of the R37S-1 in the average Convair 240 installation is 574 hours for low-tension ignition systems and 366 hours for high-tension, according to Champion.

▶**AC Plugs**—Eastern is testing AC plugs in its Constellation engines (R3350CB-1). No results are available. Erosion rate is comparable to the R33S "but there is more meat on the AC plug."

Air Force says unscheduled removal rate of AC plugs is 2-3 per 1,000 hours.

Pan American indicates that the main problem with the AC 171 plug is ground electrode erosion. In general

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But first the alarm must be given. Somebody must spot the invaders.

And there are only two ways to spot an air attack: (1) by radar, (2) with human eyes and ears. Ground radar stations cannot always spot planes flying under 5,000 feet. So we badly need civilian observers.

True, airplanes are being built to take our radar warning system off the ground. For this job Lockheed is producing WV-2 Early Warning Constellations with 360-degree radar.

Also the Navy has many Lockheed P2V Neptunes on antisubmarine patrol day and night. Their "eyes" guard against air attack too.

But we still need an additional 300,000 men and women observers to fill the low-level radar gaps. You give just a few hours a week. Call your Civilian Defense Office, or write to Ground Observers Corps, U.S. Air Force, Washington 25, D.C.

*Lockheed Starfire

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AIRCRAFT CORPORATION

BURBANK, CALIFORNIA, AND MARIETTA, GEORGIA

GROUND OBSERVER CORPS NEEDS 300,000 VOLUNTEERS

Early this summer top U.S. Air Force officials met with Civil Defense directors from 46 states and four territories, and reviewed in confidential detail the current efforts to defend America from surprise enemy attack.

"Despite a $300,000,000 radar fence around the nation's perimeter, gaps exist through which enemy aircraft could penetrate our defenses undetected," the meeting was told.

That's why America needs a total of 500,000 civilian skywatchers as members of the Ground Observer Corps. Nearly 200,000 have already volunteered.

"The only practical means of filling the gaps in our defenses is through a 24-hour operation by civilian volunteers," the meeting was told.

Why isn't America's radar network sufficient?

Defense gaps exists because of radar's line of sight principle, and radar's failure to penetrate opaque masses. Every mountain, every hill casts a shadow behind which enemy aircraft could sneak undetected. Even in perfectly flat country the curvature of the earth shortens the effective range. Equally alarming, radar is susceptible to jamming.

These gaps cannot be filled by Air Force personnel due to the staggering expense. That's why civilians are needed in 27 perimeter states to man Ground Observer Corps stations 24 hours a day. Here is a critical, patriotic job that requires just a few hours a week from each volunteer.

Aircraft too are an important part of our national warning system and of course are the backbone of defense against attack. Three advanced Lockheed planes play a vital role:

The WV-2 *Super Constellation* Early Warning Aircraft, developed for the Navy and the Air Force to extend radar's range in a whole new concept of national defense.

The P2V *Neptune* Navy Patrol Bomber, charged by the Navy with anti-submarine patrol and protection of U. S. coastal waters.

And the F-94C *Starfire*, the nearly automatic all-weather interceptor, which does the final job of climbing to the attack at terrific speed, locating the invaders, and shooting them down with more than human accuracy.

When the U. S. has all necessary planes and personnel—civilian and military—it will be difficult for enemy aircraft to penetrate U.S. defenses.

AC plug problems are mechanical; operationally the plugs are good.

▶**Power Loss at Takeoff**—NWA has been bothered by important power losses at takeoff. Torque meters register power dropoffs to as low as 150 psi. accompanied by backfiring. Usual result is an aborted takeoff. NWA has experienced 15-20 rejected takeoffs since the beginning of the year. The problem occurs most frequently when ship has been on the ground over six hours and after considerable ground run-up; it has been pinned on fouled plugs.

Pan Am stated it had undergone similar experiences and attributed power loss to three causes: spark plug fouling; errors in the torque meter system, and magneto timing.

Plug fouling was attributed principally to rich-mixture ground operation. Revised ground operating techniques have brought about a big improvement, reducing number of burnouts by 40%.

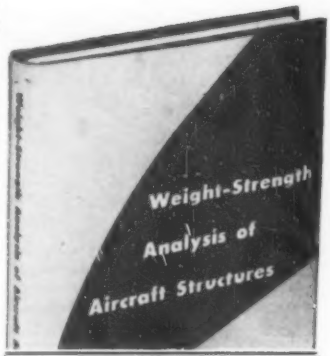
PAA is also changing plugs in lower cylinders every 100 hours to reduce fouling and is going to undrilled pistons to keep oil out of lower cylinders. NWA changes all plugs at 100 hours. Both PAA and the Air Force can find no correlation tying plug fouling to plug time. Air Force suggests that gradual power increases, to avoid sudden plug core temperature rises, will help the problem.

▶**Champion R33S**—Airline experience with the Champion R33S (or R103) plug was summed up this way: EAL has converted half of its Super Connie fleet to the plug and finds it a "one-run" unit lasting 500-550 hours. (EAL said the plug probably could operate another 150-200 hours, but it wants a half-engine-run plug, and is willing to sacrifice the extra plug time).

TWA agrees that the R33S is a one-run plug but feels it has a shorter life than Eastern says. Possible reason is that EAL's engines have spark advance limited to 25 deg. while TWA's can go up to 35 deg. in cruise. Champion estimated that the extra 10 deg. could result in a 150F increase in combustion chamber temperature.

Air Force comments about the Champion fine (platinum) wire electrode plug, the R214, were that it had a low erosion rate of 0.0025. Champion said the plug had been approved for commercial installation in the R2800 engine. The manufacturer warned that a special gapper was needed to adjust the plug's electrodes.

▶**High-Altitude Plugs?**—The Air Force is sold on the ¾-20, high altitude spark plug configuration as opposed to the ¾-24 type. A USAF spokesman stated that the plug's improved high-altitude performance far outweighs any slight weight increase. American is also a ¾-20 advocate. The carrier estimates that installation of the high-altitude



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This volume meets the need for scientifically sound methods of analyzing and predicting the structural weight of aircraft and missiles. Part I discusses methods by which the minimum weight can be determined for any material and conditions of loading. These principles of design for minimum weight are then utilized to derive weight equations for wing and fuselage structures, the subject matter of Part II. Part III includes a number of reports prepared in the course of investigations of new materials and extreme operating conditions.

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- How does the rate of loading affect the stress-strain diagram of a material at an elevated temperature?

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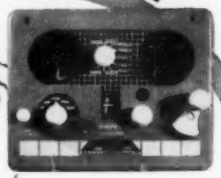

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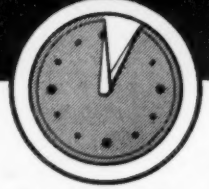

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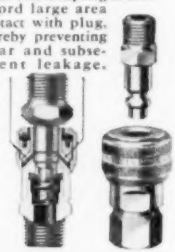

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plug on its R2800s involved a 1-lb. weight increase per engine.

Research & Development

Spark plugs with 10,000-ohm resistances have improved erosion rates. Champion does not know of a single case of resistor failure that caused engine malfunction in eight-10 years of experience. Problem is to obtain complete stability so resistor does not open up and keep plug from firing.

Rate of temperature-rise measurement technique is improving, according to Champion.

Means have been developed to measure the temperature of one plug and the resistance of another simultaneously. An eight-channel control system has been developed. One of the channels will be used for torque meter readings.

The Ethyl Corp. representative said his company is working hard to develop new anti-detonants and scavengers.

"Surface Gap Spark Plugs," developed by Braniff Airlines, are no longer under test by P&WA. Although the Braniff tests were impressive, P&WA was unable to substantiate them and discontinued testing the plug.

►**Venturi Plugs**—Al Yacavone said P&WA had tested 60 different types of the Boeing venturi plug. They were unable to demonstrate that it had better fouling characteristics than existing plugs. It is not interchangeable with other plugs because it requires about 5 deg. greater spark advance than conventional plugs to obtain same economy. It will work in certain applications but is not versatile enough to function well under a wide range of applications. The plug is hard to gap and clean, he said.

Capital reported of the Hahn spark plug it had tested that it had an erratic erosion rate. Capital said the plug was hard to clean, and had no advantages in fouling characteristics over conventional plugs; so tests were discontinued.

Magnetoes, Leads & Harnesses

Scintilla low-tension ignition system magnetoes came in for criticism by Northwest. Cam follower wear is deemed critical by the airline which is considering mid-period (400-hour) mag change as the solution. Other problems were cracked coils, difficulty in rewiring ignition manifolds.

PAA also experiences cam follower wear.

Air Force said the mag needs retiming too often, sometimes at intervals as low as 70 hours. Some mags were retimed three times per engine change.

Three-degree timing drift is maximum allowable, say the airlines. P&WA

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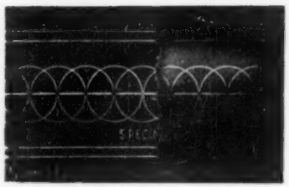


THE DYKEM COMPANY

2303A North 11th St.
St. Louis 6, Mo.

agreed that their R4360 engine could tolerate such a drift.

As a temporary expedient, UAL is lubricating the mag wick with two drops of SAE 60 oil every 200 hours.

H. C. Welch, Scintilla's chief field engineer, said his company was working hard on these problems. He pointed out that high temperatures of the mag increased rate of wear but any appreciable ventilation increased breaker point pitting, which could not be tolerated. He added that failure rate of new coils is much lower than former coils. And replacements are being supplied free of charge.

To correct magneto bearing retainer loosening, Scintilla has tightened up on shrink fit of the bearing bushing in the housing; screws are to be safetied too. A new Fafnir bearing may eliminate problem of top bearing turning in the housing.

Distributor housings are still cracking despite beefing up, so a new fix is being considered.

Collector plate-distributor brush problems on the R2800 engine are very erratic, according to Scintilla. Some operators have much trouble, others none.

Scintilla's advice: Have uniform, firm spring pressure on the brushes, to avoid brush chatter; avoid "tamperitis"—if the ignition system of an engine is running right, leave it alone.

► **Leads**—Silicone ignition leads require careful handling, being more susceptible to damage than Neoprene leads. They also fail in tension when bent to spark plug terminals, but no ignition malfunction results. They are easy to rewire, and stand up well to heat, the conference heard. P&WA is using silicone leads exclusively on jet engines with considerable success.

Analyzers

Use of analyzers, both the Scintilla ignition and Sperry engine units, is expanding.

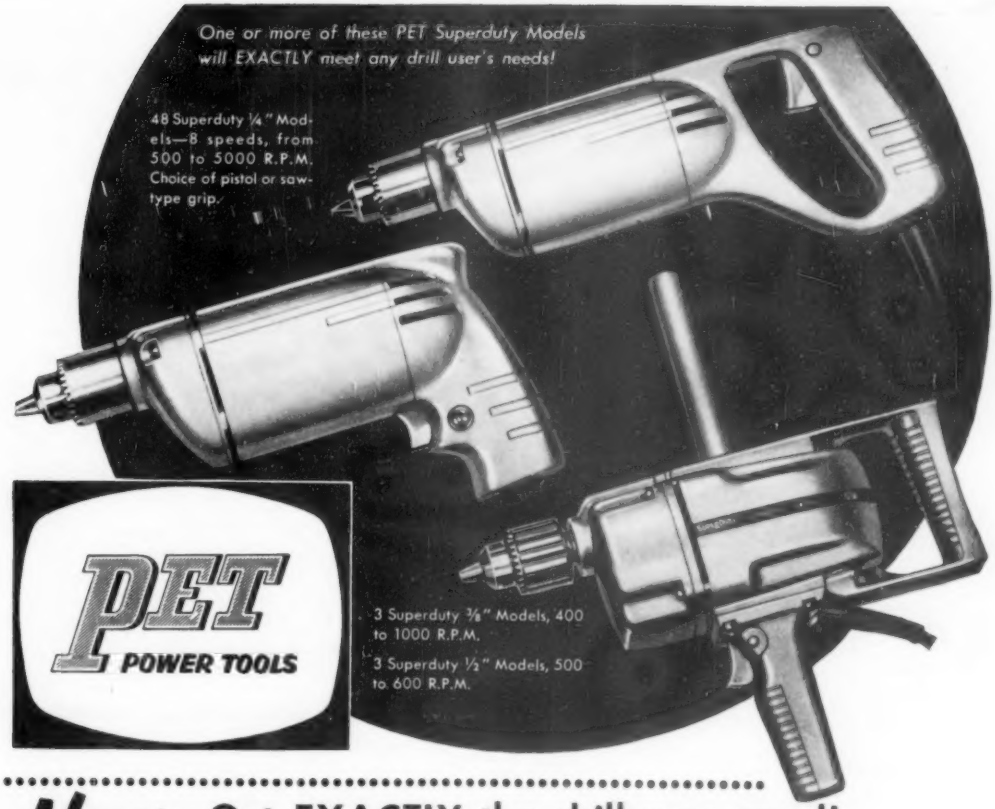
• **American** is issuing temporary type kits to allow mechanics to hook up an analyzer and run the wiring into the cabin of the plane where they can read its scope in comfort. The airline wants a modification which would put a reference marker on the breaker assembly.

• **Eastern** is wiring its aircraft for ground use of the analyzer—the first step toward using the unit as an airborne instrument.

• **TCA** is happy with its analyzer installation, said that its mechanics found a series of poor magnetic lubricators by means of analyzers.

• **United** is embarking on an analyzer program.

• **TWA**, speaking of Scintilla's exclusive feature—load control—indicated that its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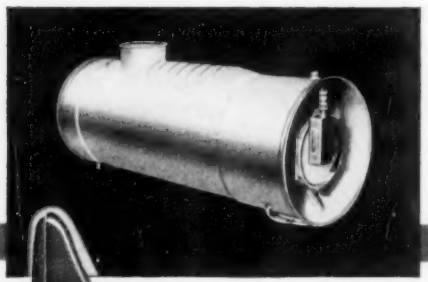

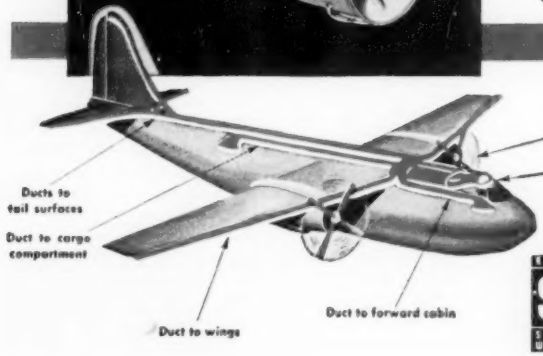
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► **Conference Officers**—The Champion conference was headed up by Burns Maus, special airlines' representative, who arranged all details of the meeting. The meetings themselves were ably governed by six chairmen: A. B. Holmer, Scandinavian Airlines System; M. C. Fillmore, Sabena; R. L. Anderson, Chicago & Southern; L. P. Larson, Northwest; F. W. Lochner, Eastern, and E. P. Kovac, American.

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Rocket Test Aid Measures Pressures

A transducer accurate enough for measuring pressure conditions in an aircraft pressure system under flight test has been placed in the aviation sales showcase by Consolidated Engineering Corp.

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Present models are the low-pressure variety, but later versions will be designed for rocket propulsion testing under high pressure and corrosive fluid conditions. Output of the unit is said to be linear within 0.5% of full scale.

In operation, fluid or gas flowing into the unit changes the dimensions of a cylinder in proportion to pressure variations. This expansion or contraction changes, in turn, the resistance of wire wound around the cylinder. The wire constitutes the active arms of a four-arm bridge circuit. The resulting bridge-unbalance voltage is likewise proportional to any pressure change and can be fed to meters and other indicating or measuring equipment.

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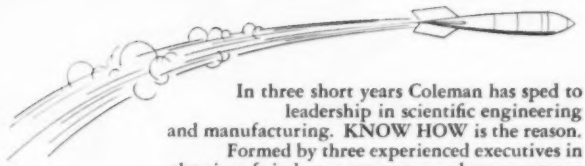

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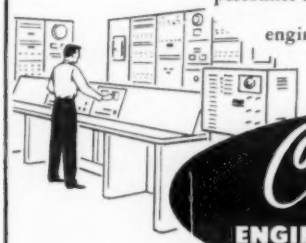

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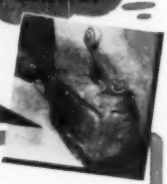

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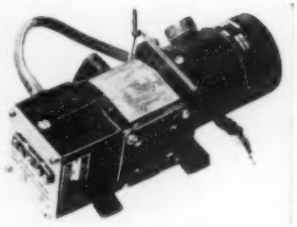

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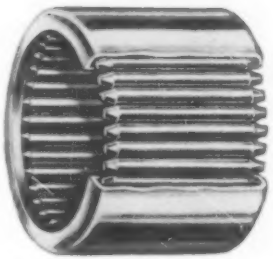

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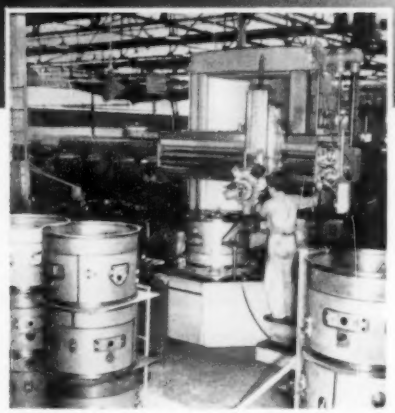

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Switch to Coach May Alter Plane Design

- **DC-6, Connie unsuitable for five-abreast seating.**
- **Ticket-credit plans may be offered passengers.**

By Lee Moore

Airlines and manufacturers are discovering this month that the whole air transport industry will change from 85% first-class to over 50% aircoach within a very few years. This will affect everything from the physical shape and layout of future transports to the technique of passenger sales promotion.

The significant shift to coach is being revealed by the major airlines at the current Civil Aeronautics Board hearings on how to prevent nonsked airlines' aircoach service from competing with scheduled lines. Virtually all the big carriers surprised each other as they took the stand, one by one, and announced vast coach expansion plans. Eastern may make a similar announcement soon in Miami, where the hearings resumed this week after two months in Washington.

▶**Switch Significance**—The switch to coach affects the manufacturers as well as the airlines.

• **Aircraft design.** To the manufacturers it means reevaluation of the new transport designs on their drawing boards. Every bit of payload capacity must be laid out for quick and cheap conversion to high-density seating. For instance, the airlines are paying dearly today for the fact that the DC-6 and Constellation fuselages were not planned for five-abreast seating, nor for any of the other peculiarities of high-density seating and aircoach or "tourist" service.

The Connie is fat in the middle but tapers, so that five-abreast seating is available in the middle section only.

The DC-6 does not taper, but is a little too narrow all the way to make five-abreast seating comfortable for the portly passenger. The narrowness affects not only width of the fuselage but the shape and flexibility of almost every facility—baggage racks, cargo bins, galley, lavatory.

American Airlines, for instance, wants the Douglas DC-8 jet transport readily convertible to five-abreast seating to make it economical on shorter hauls of less than about 1,200 mi. Putting in a fifth row of seats automatically cuts unit cost per available passenger by about 20%.

• **New sales techniques.** To the airlines the aircoach capacity expansion means also a rapid shift into mass-market sales promotion.

The director of the CAB Bureau of Air Operation, Gordon Bain, says the next step may be airline use of consumer credit financing plans and advertising similar to the "buy now and pay later" types long used to push sales of consumer durables. In order to compete for the consumers' limited supply of spare dollars, the airlines may have to make use of the same technique.

American now says that the cost-conscious vacationists—90% of whom travel by auto—offer the airlines their biggest field for expansion. To woo this market from car to air the airlines may also have to promote rent-a-car service at the destination of a plane something like the one National Airlines is pioneering in Florida, Bain believes.

▶**Coach Development**—The scheduled domestic airlines' coach business is up 70% over a year ago. Load factors are so high it's still difficult to get a reservation.

Trans World Airlines—presently the leader in aircoach expansion—predicts that by 1960 aircoach volume will be bigger than total airline passenger volume today. Here's how TWA reached that conclusion: CAA predicts 18 billion domestic passenger miles by 1960. TWA boosts that to 20 billion. Air Transport Assn. predicts this year's total domestic passenger volume at 11 billion. Since TWA believes coach volume will exceed standard volume, the coach business by 1960 will be bigger than today's total business.

▶**Premium Service**—The luxury airline service now called "standard" will not wither away. AA and others have said at the recent CAB hearings that they will add more plush to that service. Even before they have jet transports to offer the premium traveler, the airlines will be offering more and more "extras" on luxury service to serve the traveler who has the extra cash to spend making his trip more restful and pleasant. Airlines will experiment with better seats, meals, baggage handling, accommodations, message and dictaphone service.

▶**Short Haul Different**—The short-haul air service is a third type. It has already fairly high-density seating, and usually without meal service. But you can't call it coach because the fare is high.

From the customer's point of view, short-haul air travel is not coach. That is because he can go by train cheaper and almost as fast on many routes. Short-haul rates can't be made much cheaper on some routes because unit-costs rise rapidly as the trip length grows shorter. Takeoff and landing, ticketing, ramp service and ramp time are all costs that dominate short-haul economics.

However, some reduction of short-haul air rates will be possible if airlines use flexible seating arrangements, as they are now being urged to by Consolidated Vultee Aircraft Co., maker of the new Convair 340s (of which the airlines have over 100 on order). Also, as long-haul aircoach grows, some airlines like Capital, TWA and United are already making intermediate stops on some runs—giving the

Domestic Scheduled Airlines

Year	Average Air Fares (Cents) All services	Coach	Passenger Business (Millions) Total	Coach
1946	4.6	None	$273	None
1947	5.1	None	303	None
1948	5.7	*	335	*
1949	5.7	4	378	$10
1950	5.6	4.1	430	43
1951	5.6	4.5	568	57
1952 (Est.)	5.5	4.2	625	100

* *First service did not start until Nov. 4, 1948.*
Est.: Unofficial estimates by AVIATION WEEK *from Air Transport Assn. and CAB.*

equivalent of short-haul coach service on long-haul routes. This is an experiment for TWA and United. American says it won't pay well on many routes, but TWA is tentatively prepared to argue that.

▶**New Rate Structure**—Thus, the airline fare and service system is growing into three fairly distinct patterns: First and most important there is the growing long- and medium-haul aircoach at 4 to 4½ cents a mile. Next there is the traditional long- and medium-haul luxury service at about 6 cents a mile. Finally, there is the expensive short-haul service at about 6½ cents a mile (7 cents a mile including limousine service).

Short-haul air service will come into its own economically with advent of big helicopters at the end of this decade.

However, airlines are not ordering coach planes direct from the manufacturer yet. Only Pan American is known to have ordered a coach fleet that way. The others may follow eventually. Meanwhile, most of them prefer to convert old planes to coach seating and give their premium fare customers the newest and fastest planes. It is too soon to tell in detail how the coach development will eventually affect manufacturers.

▶**Trend of Air Fares**—Coach service is already expanded so that it will account for an estimated $90 to $100 million of this year's predicted $625-million domestic airline passenger revenue.

The airlines used to have a single unit fare per mile (regardless of distance). Now they are going to a "tapering" fare structure—high on the short haul, low on the long haul. The $1 fare increase on all airline tickets this spring further accentuated that trend. That's the way unit costs taper and the industry is now sold on the theory that fares should taper with cost.

The trend will increase automatically as coach becomes the main means of travel over long and medium distances between cities. This CAB review of the air fare structure will be a stormy one. But the outlook is that rates won't change much unless costs do. "Don't rock the boat now," the airlines urged recently, trying to get CAB to drop the fare investigation.

The airlines point out that fares are already much lower than they look. Family fare and coach service will account for 28% of trunklines' passenger revenue this year, and nearly one-third of it next year, ATA predicts. The 5% roundtrip discount also cuts the fare below face value.

▶**Individual Coach Plans**—Here are further recent developments of individual airlines' coach plans and policies revealed at the CAB hearing—in addition to those briefed in AVIATION WEEK Oct. 20, p. 87 and Oct. 27, p. 17.

• **TWA.** In a few years, TWA believes, coach passenger miles, both domestically and internationally, will exceed "standard." It has already done this on the trans-Atlantic, transcontinental and intra-California routes. Sales Vice President E. O. Cocke said at the CAB nonsked hearings that—judging by expansion plans announced before TWA's at the hearings—"certainly by next year the scheduled carriers would be able to take care of the market."

TWA therefore has proposed that CAB put the "nonsked" airlines out of the aircoach business—now that the scheduled airlines are ready to serve the demand adequately themselves. Cocke proposed that the nonskeds be restricted to special charters only—both private and government charters. And TWA proposed that even their CAB authorization for that type service be "temporary."

Asked in cross-examination by the nonscheduled airlines' attorney, Albert Bietal, if those TWA recommendations would not so impair the "nonskeds" credit that they could not get public financing, Cocke answered: "I don't know."

The nonsked attorney rested his case with that answer. While CAB may succeed in restricting nonsked operations, it has not yet killed them off. Nonsked business (international, contract, and domestic, altogether) has gained 50% over a year ago. But military contracts plus evasion of CAB restrictive regulations have accounted for this. Actually, CAB is gaining the upper hand and is expected to restrain nonsked coach operation more and more.

AIRLIFT TV CABLE

This massive reel of coaxial television cable was airfreighted recently in a Slick Airways' Douglas DC-6A Liftmaster from New York to California. The 4,000 ft. of cable were needed for installation in a community aerial to bring TV signals down from a mountain.

TWA's seat miles next year will be 1.2 billion coach and 2 billion first-class, Cocke predicts. Coach load factor will be 75% and first-class about 70%.

Internationally, 56% of this summer's trans-Atlantic service by TWA was coach, next year it will be more; in 1954 80%; and eventually 85%, Cocke stated at the CAB hearings.

• **United Air Lines.** United will finish a study within a few months and decide how to convert up to 17 DC-6 type planes to coach seating.

Here are preliminary conversion-cost alternatives furnished United by its engineering department:

DC-6 with 70 passenger seats $35,000; 78 seats $38,000; 81 seats $50,000.

DC-6B with 78 passenger seats $35,000; 86 seats $38,000; and 89 seats $41,000.

United also has studied coach possibilities of its 50 Convair 340s but has not yet decided on any seating change. The DC-7 seating arrangement is still open, as Douglas has not started production yet.

United says it will invest $143,504,000 in flight equipment from 1952 through 1955.

United, once skeptical of the economy of coach, is now even experimenting along with TWA on medium-haul coach. American says short-haul coach is not economical, as the service is already high density.

• **American.** AA first converted to a 70-passenger DC-6 coach as a compromise between the "American standard" of comfortable service as balanced against the economic need of high-density seating to lower the fare. Now American plans 80-passenger coaches. Of the 10 extra seats, nine will go in the forward cargo bin and the tenth goes in aft part of the center aisle, narrowing passage at that point.

American already carries more coach than first-class passengers transcontinentally—will almost double coach capacity by next spring, with a total of ten 80-seat DC-6s operating.

• **National.** NAL has been a consistent advocate of the daylight coach—had to fight years for CAB acceptance. Short of equipment for its winter season right now, National's coach service is "on rotation." That means National is using all its DC-4s and DC-6s in coach and first-class as demand and schedule commitments permit. NAL varies its DC-4s from 61 to 69 seats by using eight removable seats. The 4 DC-7s, 8 DC-6Bs and 8 Convairs on order will allow National more coach service.

• **Capital.** Capital's James W. Austin,

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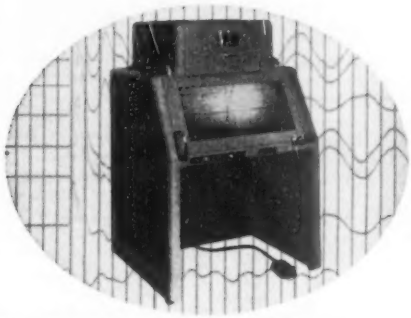

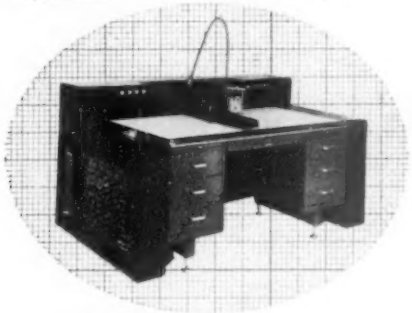

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assistant to the president, says he believes Capital has spent more money on coach advertising than any other carrier—$900,000. And Capital has a tough time competing with United, American, TWA and Eastern for 75% of its business, he adds. Their competition and better routes have hurt Capital coach load factors, which have been: 1948 73%, 1949 68%, 1950 62%, and 1951 64%. Break-even loads range from 48 to 65%. Capital runs only night coach service because of its equipment shortage, but will replace the night coach with DC-4 day coach service when its five additional Constellations arrive from KLM for first-class.

• **Northwest.** Assistant Secretary C. L. Stewart says that, in August, 40% of Northwest's domestic revenue passenger miles were coach. And next summer the line will add "at least one" more transcontinental DC-4 coach.

Northwest, like Capital, is short of equipment. Northwest expects soon to buy DC-6 or Constellation equipment.

Meanwhile, Stewart says the company opposes trans-Pacific coach. Northwest claims there are not yet enough trade and tourist incentives in Tokyo and other Pacific points to make coach service worth while. Observers also believe Northwest is worried about Pacific competitor PanAm's superior equipment situation with coach DC-6Bs all ready to go. Stewart says the company loses money consistently on its Honolulu service because PanAm competition forced the use of Stratocruisers instead of DC-4s.

But Northwest believes in further coach expansion, too, testimony revealed. It's just a matter of time.

Silver City Completes Year on 'Minor Airlift'

(*McGraw-Hill World News*)

London—Silver City Airways, unscheduled freight operator, last month completed its first year hauling blockaded exports from Berlin to Hamburg in a "Minor Airlift." In 1,050 round-trips, usings first one Bristol 170 and then two, the line flew approximately 900,000 revenue ton-miles carrying 5,500 long tons or 12,320,000 lb. of freight.

On nearly all trips on the 160-mi. between Tempelhof and Hamburg, the freighters carry maximum loads of more than 10,000 lb., usually electrical equipment, diesel lorries, soap and precision machinery. The contract calls only for transportation of freight out of Berlin, but frequently a backload is carried—on one occasion this comprised some deer for a West Berlin forest.

Mexico Steps Up Airport Facilities

(*McGraw-Hill World News*)

Mexico City—A new $1-million airline terminal is going up at Puerto Marques adjacent to the resort town of Acapulco on the Pacific Coast. Reason for the installation is an ever-increasing amount of passenger traffic into Acapulco—numbering over 150,000 yearly.

Other airport construction and modernization work is being pushed in Mexico. New fields are being built at Nogales, Hermosillo and La Paz, and a new passenger depot and runway are being put in at San Luis Potosi Airport. Late this year a new passenger terminal will be placed in use at Mexico City's Central Airport.

Recently President Aleman dedicated a new military field at Santa Lucia, 30 miles north of Mexico City.

British Outline Plans To Expand Gatwick

(*McGraw-Hill World News*)

London—Details of a large-scale development of Gatwick Airport to augment ground facilities for handling the increasing air traffic in the London area, expected to double by 1960, have been announced by the Ministry of Civil Aviation. Present expansion of London Airport into a major air terminal is thought inadequate to meet future demands.

Plans for Gatwick call for construction of two main parallel runways, each 7,000 ft. long, 200 ft. wide, 3,200 ft. apart, the first to be completed by 1956. A third runway 5,000 ft. long and 150 ft. wide is planned for 1958. A passenger terminal and maintenance area also are planned.

Some objections to Gatwick as a major terminal are that it is 27 mi. from the center of London, railway facilities will be difficult to arrange, the airfield is likely to be waterlogged in winter, and its proximity to London Airport might confuse air traffic.

Advantages include: shortening of the routes to the Continent with a consequent saving of fuel; it would be cheaper to enlarge an airfield already in use than build a major new airport.

Iran Service

Recent British Overseas Airways Corp. moves in Teheran indicate that the carrier plans to cancel its weekly service to the Iranian capital. BOAC Chairman Sir Miles Thomas has been quoted as saying that the airline plans to remove its plane spares from Teheran.

Dedicate Heliport

Los Angeles—A prediction that 25-40 passenger helicopters as big as a DC-3 will be carrying mail and passengers in the Los Angeles area within five years was voiced by Igor Sikorsky at the dedication of the new Jesse M. Donaldson Heliport atop the U. S. Post Office Terminal Annex here.

The dedication, coinciding with the fifth anniversary of Los Angeles Airways copter mail service, was also the occasion for a plea by LAA President Clarence Belinn for essential legislation and engineering improvements, navigation aids and better ground facilities to speed nationwide civilian use of rotary-wing craft.

CAA Administrator Horne hinted at greater versatility and all-weather operation, saying that work is now under way to make possible full instrument flying by copters and to develop necessary ground aids.

During the dedication, LAA's S-51s continued their shuttle mail service, with one of the carrier's new S-55s on the roof for display. Copters now have made more than 21,000 landings and exchanged more than 15 million pounds of mail on the Post Office roof.

Italians Lack Research Funds

(McGraw-Hill World News)

Rome—Although there has been a noticeable improvement in the production phases of the Italian aircraft industry because of NATO contracts, there exists a real need for boosting research and development so that native engineers will be brought abreast of current progress, says a report compiled by an Italian Ministry committee of inquiry which has investigated the industry.

The report concludes that the government should attempt to have some NATO funds assigned to push Italian experimental work to make up for the lag in this field.

It is also noted that the industry's production potential is only partly active and enough remains to bring it up to the mark achieved just before World War II. Only 6,000 workers are now engaged in aviation.

The committee ascertained that 17 firms could be used in building airframes, four for manufacturing powerplants and 20 in making instruments, accessories and other equipment. Twenty-one of the plants are located in northern Italy, 10 in the central section and 10 in the south and on the islands. Present plans call for increasing the aviation industry in southern Italy.

New Agreement Set On Service to Africa

(McGraw-Hill World News)

Salisbury, S. Rhod.—Agreement has been reached on a new pattern for air services between Great Britain and southern Africa by Central African Airways, British Overseas Airways Corp. and South African Airways, according to an announcement by the general manager of CAA, R. G. McCoy. The governments concerned must approve the agreement before details of the new services can be disclosed.

The agreement was worked out at a recent International Air Transport Assn. conference in Geneva.

It is planned that Central Africa is to play an increasing part on the air routes between the United Kingdom and southern Africa.

Map in Cabin Shows Location of Plane

(McGraw-Hill World News)

London—A device designed to show air passengers precisely where they are at any given moment while in flight is being developed by an English firm. It is an automatic screen map for airliner cabins. Controlled from the automatic Decca Navigator in the flight deck, the screen, measuring 21 in. by 16 in., shows the plane's position by means of a dot of light moving across a series of transparent screen maps.

The Decca Navigator has been adopted by British European Airways and will go into service first on the Viscount turboprop, but the screen map for passengers is not yet in production.

Copters Speed Mapping Project

This past summer two helicopters mapped 57,000 sq. mi. of Canadian territory west of Hudson Bay, spotting areas rich in valuable metals. Officials estimate it would have taken a ground party 25 years to handle the same task.

The task cost $215,000 or approximately $3.80 per square mile. The copters averaged 900 sq. mi. a day and some 1,500 landings were made during the survey to permit geologists to get a first-hand look at certain geological features.

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Aussie Carrier Asks License for Skytrain

(*McGraw-Hill World News*)

Melbourne—Butler Air Transport of Australia has applied to the Department of Civil Aviation for a license to operate skytrains following experiments which it was claimed gave good results and pointed to a promising future for skytrains on certain routes.

A tug aircraft, towing a number of cargo gliders of special design, would drop the gliders at various points along the route and would pick them up on the way back, already reloaded. The gliders would be picked up by the snatch method.

The company, now using mostly DC-3's, expects freight charges to be as low as 2¢ a ton-mile.

$10-Million Loan Granted ANA

(*McGraw-Hill World News*)

Melbourne—Australian National Airways has been granted a $10-million government-guaranteed loan for planes and other new equipment. The carrier has six turboprop-powered Vickers Viscounts on order for delivery in 1954.

The government is ready to give ANA equal privileges with the national carrier, Trans-Australia Airlines, such as sharing airmail.

In return for these concessions, ANA is understood to have withdrawn a threat to go out of business.

Radar for Portland

Portland—Installation of airport surveillance radar at a cost of $110,000, the first of its kind in the Pacific Northwest, will be completed soon at Portland International Airport.

The General Electric equipment will enable controllers to guide aircraft down to a minimum of 500 ft. in all weather, according to M. E. Eisenbach, Civil Aeronautics Administration's regional chief of radar maintenance. Adjustment to five horizontal scales, at 6, 10, 20, 30 and 60 mi., will be possible with the Model ASR-2 installation. Vertical equipment will be installed later to complete the new GCA facilities.

Siam Pilots Trained

(*McGraw-Hill World News*)

Melbourne—First group of Thai Airways pilots has started four-engine training with Trans-Australia Airlines under International Civil Aviation Organization's technical assistance program. The course will take about a year and include 500 hours of route flying. The Siamese pilots will command Thai Airways' DC-4s and check out other personnel.

Japan May Operate Route to Australia

(*McGraw-Hill World News*)

The Japanese government is expected to begin negotiations with the Australian government for permission to operate an airline from Japan to Australia by way of Hong Kong and Singapore, with possible stops also at Djakarta, Indonesia.

It is rumored that Japan Air Lines is interested in this route and would use Skymasters and, later, probably Constellations.

The planned Japanese use of Constellations would mean the same step by Qantas.

Permission is expected to be granted because a refusal might affect flights to Japan by Qantas and BOAC.

Australian Traffic

(*McGraw-Hill World News*)

Melbourne—Only slight gains and, in some cases, losses were registered by Australian airlines in the fiscal year ended June 30.

On domestic runs, the number of passengers carried increased 8.8% to 1,879,321 compared with the previous period and route mileage went up from 73,788 to 86,600. But freight dropped from 53,483 tons to 52,058 tons and mail ton-miles went down from 1951's 1,403,408 ton miles to 1,235,134.

In international services, route mileage went down slightly to 34,743 but passengers went up from 40,468 to 47,498. Freight went from the previous year's 968 tons to 1,032. Mail ton-miles also showed an increase to 5,036,295.

Copter Mail Success

Since August 1950 when Sabena Belgian Airlines' helicopter mail service first went into operation in Belgium, more than 235,000 lb. of mail, or 21,306,000 letters, have been carried on its route which starts at Brussels and covers nine Belgian cities in a 3 hr. and 43 min. circuit. Other Belgian communities are expected to be added to the service before the end of year.

By the end of the second year of operation completed daily flights over the route averaged better than 95%. Cost of operation is given as 63 cents per mi.

SHORTLINES

▶ **Capital Airlines** has CAB approval to extend some coach flights from Washington to Norfolk–fare $7.

▶ **International Civil Aviation Organization** says Japan has asked to join ICAO, but must win UN General Assembly approval first. Japan's treaty, signed a year ago, binds it to abide by the ICAO rules while waiting to join the organization.

▶ **Riddle Aviation Co.** request for CAB exemption to give Philadelphia cargo service was denied at National Airlines request. CAB will study more argument on it.

▶ **Sabena Belgian Airlines** started a weekly DC-4 airfreight service from Brussels to Johannesburg Oct. 31.

▶ **San Francisco International Airport** is getting a centerline approach light system–the type favored by airlines and their pilots. The joint city-CAA job will be operating about the end of this year. The main runway will get a 3,000-ft. line; the others will have 500-ft. stub lines.

▶ **Seaboard & Western Airlines** August flights gained 18% over a year ago. . . . Company has added Hamburg, fifth point in Germany, to its airfreight routes.

▶ **Slick Airways** has awarded its annual airfreight trophy to Lederle Laboratories division of American Cyanamid Co. for exploiting airfreight advantages and developing new packaging techniques for perishables.

▶ **Trans World Airlines** September revenue passenger-miles were up 31% over a year ago to 183,000,000 domestically, and 10% to 46,000,000 internationally. . . . The carrier hauled 21,000 trans-Atlantic coach passengers May-August, two-thirds as much as its total standard-class traffic a year ago. . . . Company reports August passenger miles topped previous records with 178,636,000 domestic and 51,613,000 international miles. . . . Asks CAB permission for nonstop service Cincinnati-Washington.

▶ **United Air Lines'** Convairs start service Nov. 16 with 27 slated for delivery by year's end. UAL has 50 on order, worth $30 million. . . . Company's September traffic gained 30% over a year ago to 241,507,000 revenue passenger-miles, but was off 3% from August. Mail gained 2%, express 14% and freight 38%.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** EQUIPMENT: USED OR RESALE

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$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Position Wanted & Individual Selling Opportunity undisplayed advertising rate is ½ the above rates payable in advance.

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The advertising rate is $15.45 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An *advertising inch is measured* ⅞" vertically on one column, 3 columns 30 inches to a page.

WANTED

TECHNICAL SERVICE ENGINEERS

FOR

JET FUEL METERING DIVISION

WITH

BENDIX PRODUCTS DIVISION

For position in Technical Service Department, working on aircraft jet engine fuel metering controls. The men we are looking for will, after proper training and orientation, have charge of all service contacts with one or more of our customers. Must be willing to do a small amount of traveling at company expense.

Men with M.E., E.E., or A.E. degree, and experience in jet engine fuel metering preferred. Applicants without this background will be considered, as we are primarily concerned with a man with initiative and a pleasing personality.

Salary commensurate with experience and ability.

Bendix is a pioneer producer of commercial and military aircraft equipment. Excellent working conditions in a pleasant midwestern community.

Send outline of education and experience to:

Fuel Metering Technical Service

BENDIX PRODUCTS DIVISION

BENDIX AVIATION CORPORATION

SOUTH BEND 20, INDIANA

METALLURGIST

Ferrous and non-ferrous. Must have five years well-rounded industrial experience, preferably aircraft, in metallography, heat treating, consultation and design considerations.

Starting salary commensurate with experience background. For more information about this position and our company, send resume to

Section M
Technical Placement Supervisor

McDONNELL AIRCRAFT CORPORATION

St. Louis 3, Missouri

RADIO MAN

To repair and install aircraft radio equipment. Must have experience on Bendix, Collins, Lear, ARC. Vacation, excellent working conditions. High salary. Reply

P-5674, Aviation Week
330 W. 42 St., New York 36, N. Y.

Brunswick

Leader In The Field Of Recreation Equipment For More Than A Century

Now embarking on a rapidly expanding, long-range aircraft program with Air Force and Navy contracts to build ailerons, flaps, wing tips, stabilizers, rudders, fins, canopies, radomes, and ejection seats has two openings which offer an exceptional opportunity to qualified applicants.

PRODUCTION SUPERINTENDENT

To take complete charge of aircraft production operations. Includes heat treat, finishing, stretch press, hydro-press, drop hammer, and all assembly operations. Ultimate program will involve supervision of about 500 people. Most equipment brand new.

SR. PROJECT ENGINEER

Will have responsibility for guiding single projects from tool planning into production. Tool planning and processing experience on airframe components required. These openings are key positions in a manufacturing facility covering more than a million square feet of floor space carrying on a diversified operation in metal, plastics, rubber and wood. Future growth and advancement are assured by well-founded plans for expansion of commercial product lines.

Write Technical Placement Supervisor

THE BRUNSWICK-BALKE-COLLENDER COMPANY

MUSKEGON, MICHIGAN

We desire personnel of the highest caliber—experienced in the field of airborne automatic electro-mechanical control equipment.

★

ENGINEERS

MECHANICAL DESIGN
ELECTRONIC
SERVO

DESIGNERS-LAYOUT MEN

ELECTRONIC
MECHANICAL

This work deals with the manufacture and development of highly complex equipment of the most advanced type in a new and expanding division of an established firm with 20 years of successful experience in the precision instrument field.

We cite a few of the good reasons why you might like to join our organization . . .

SALARY increases are based on merit and initiative—two weeks VACATION, HOSPITALIZATION BENEFITS, GM's own INSURANCE PLAN—POSITIONS ARE PERMANENT due to long range manufacturing and developing programs—EXPENSES incident to interviews and moving all absorbed by company—HOUSING and LIVING CONDITIONS among the best and finest of any along Lake Michigan.

- We have a Junior Engineering Training Program of one year for inexperienced engineering graduates. Opportunity to become acquainted with all phases of industry.
- For the convenience and direct use of engineers in our Engineering Department, we have our own model shop where highest skilled mechanics are employed.
- Educational opportunities for advanced degrees available at U. of W., Marquette, Technical engineering offered at Milwaukee Vocational School.

. . . all inquiries answered—write or apply . . .

★ *AC SPARK PLUG DIVISION*

GENERAL MOTORS CORPORATION

1925 E. KENILWORTH PL. MILWAUKEE 2, WIS.

DESIGNERS
CHECKERS
DRAFTSMEN

Mechanical—minimum of 3 years experience in sheet metal assemblies, airframes, aircraft structures, mechanisms, or packaging.

Electrical—minimum of 3 years experience in aircraft wiring, chassis layout, electro-mechanical packaging, or electrical installations.

AERODYNAMICIST
or PHYSICIST

Strong math background required. Experience in stability and control problems helpful.

ELECTRONIC
ENGINEERS

Several years general electronic experience desired.

Engineering Department

ENGINEERING AND RESEARCH CORPORATION
Riverdale, Md.
(Suburban Washington, D. C.)

ENGINEERS:

We've Got what you're Looking for!

T. H. Beck, Manager of Engineering. Is an engineering veteran of over 22 years in the aviation and related industries.

A secure future, exceptional opportunities for advancement, and a high starting salary await you at FAIRCHILD. We have openings right now for qualified engineers and designers in all phases of aircraft manufacturing; we need top-notch men to help us in our long-range military program: turning out the famous C-119 Flying Boxcar and other projects for the U.S. Air Force.

FAIRCHILD provides paid vacations and liberal health and life insurance coverage. We work a 5-day, 40-hour week as a base. Premium is paid when longer work week is scheduled.

ENGINE AND AIRPLANE CORPORATION
FAIRCHILD *Aircraft Division*
HAGERSTOWN, MARYLAND

ENGINEERS!

New Aircraft Projects AT

RYAN

SAN DIEGO

OPENINGS FOR

- **Aerodynamicists**
- **Airframe Designers**
- **Stress Analysts**
- **Power Plant Engineers**
- **Draftsmen**

Work will be on new Ryan aircraft projects

Replies to Director of Engineering will be held in strict confidence.

RYAN
AERONAUTICAL COMPANY
San Diego 12, California

MASTER PLANNER SCHEDULER

Qualified graduate engineer needed to perform functions of Master Planner and Scheduler for large engineering organization. Must be experienced in aircraft engineering field, particularly in engineering planning, estimating and scheduling work. State age, experience, present status and salary expected. Write

P-5835, Aviation Week
520 N. Michigan Ave., Chicago 11, Ill.

RESEARCH AND DEVELOPMENT

forge the KEY to America's future in the AIR
take YOUR place . . . with GOODYEAR AIRCRAFT

The continued and steady growth of established research and development projects presents a number of unusual opportunities for outstanding and experienced men.

SCIENTISTS **ENGINEERS** **DESIGNERS**

Positions are available in our organization for qualified personnel in the following fields:

- **Electrical Systems**
- **Circuit Analysis**
- **Analog Computers**
- **Servomechanisms**
- **Test Equipment**
- **Structures**
- **Aerodynamics**
- **Applied Mathematics**
- **Electronics**
- **Physics**
- **Stress Analysis**
- **Flight Test**
- **Missile Design**
- **Dynamics**
- **Microwaves**

Openings also exist for welding engineers, civil engineers, and mechanical engineers with experience in metals fabrication; and for personnel with ability and experience in technical editing, art, and motion pictures.

Positions are available at several levels, and inquiries are also invited from recent graduates. Salaries are based on education, ability, and experience. Liberal salary, vacation, insurance, and retirement plans are yours if you qualify.

If YOU are interested in a secure future, write, giving full details, to
Mr. C. G. Jones, Salary Personnel Department.

GOODYEAR AIRCRAFT CORPORATION, 1210 Massillon Road, Akron 15, Ohio

TEST ENGINEERS

for

Test & Development Engineering
in connection with Design,
Development & Production of

UNCONVENTIONAL POWER PLANTS

Unusual Opportunities

FAIRCHILD

Engine Division

of the

FAIRCHILD ENGINE & AIRPLANE CORP.
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Personal interviews Mon. thru Fri. 9 AM-4 PM
Or Send Detailed Resume All Replies Confidential

Are you a

HELICOPTER ENGINEER?

Would you like to work

IN CALIFORNIA?

If so, there is an exceptional opportunity for the right man to head up an important helicopter development unit for a long-established leading California aircraft manufacturer.

Address full details including educational background and employment record to

P-5763
Aviation Week
1111 Wilshire Blvd.
Los Angeles 17, Calif.

TEST ENGINEERS
AERODYNAMIC
COMBUSTION
DESIGN ENGINEER
ELECTRONIC ENGINEER

Needed by the University of Southern California for operation of the Aerodynamic Test Division, Naval Air Missile Test Center, Point Mugu, Calif. Excellent opportunities exist for advancement at this new Windtunnel and Combustion facility.

Apply to

UNIV. OF SOUTHERN CALIF.
ENGINEERING CENTER
935 W. 37th Street
Los Angeles 7, Calif.

YOUNG AND AGGRESSIVE
PUBLIC RELATIONS AND ADVERTISING MANAGER

Needed at Once. By Leading Local Aviation Business. Eastern Pennsylvania Area.

P-5830, Aviation Week
330 W. 42nd St., New York 36, N. Y.

FLUTTER AND VIBRATION RESEARCH

Several positions are open in theoretical and experimental research in the field of aeroelasticity. At least two years of experience required. For further details, write to

Cornell Aeronautical Laboratory
P.O. Box 235, Buffalo 21, New York

If possible, please enclose a resume.

JOHN S. HAMMOND, INC.

Greenwich, Connecticut

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITION VACANT

FIELD ENGINEERING Representative: Progressive Manufacturer, Automatic Controls has opening for Technical representative calling major aircraft accounts. Midwest location. Aero engineering sales background necessary. Salary and bonus. Permanent career. P-5911, Aviation Week.

SELLING OPPORTUNITY OFFERED

WELL-ESTABLISHED manufacturer whose small tools are used extensively by most major aircraft companies is considering sales representatives in a few choice territories including Michigan, Illinois, Wisconsin, Indiana, Ohio, Missouri, Georgia and Texas. Products are nationally advertised, have excellent acceptance. Little competition. A real opportunity. Send complete information on territory covered, lines carried and number of men traveled to RW-5856, Aviation Week.

POSITIONS WANTED

ATR PILOT: Airline experience. All ratings. Age 33, 11 years flying experience. 9600 hrs., DC-4, DC-3, Convair, Beechcraft. 4 years experience with national concern. College education, excellent references. Resume on request. PW-5823, Aviation Week.

COMPANY PILOT or sales Rep. Airline and sales background. All ratings including A & E Amphibian exper. College Grad., family man, domestic or foreign. PW-5717, Aviation Week.

WANTED JOB on Orbit or Moon Rocket-Structural Eng. 32. Experience: 10 years in Aircraft, 7 in High Mass Ratio Rockets and other Pilotless Vehicles. Reply PW-5775, Aviation Week.

UNUSUAL OPPORTUNITIES

can be found each week in the

SEARCHLIGHT SECTION OF

AVIATION WEEK

1ST
- BOMBER
- PURSUIT SHIP
- TWIN ENGINE BOMBER
- AMERICAN AIRCRAFT POWER TURRET
- SUCCESSFUL AMERICAN DESIGNED HIGH ALTITUDE ROCKET

1ST

IN OPPORTUNITY FOR ENGINEERS

Interesting Career Work On Guided Missiles, Rockets and Conventional Aircraft in—

STRUCTURAL DESIGN
Airframe and Mechanical

WEIGHT ENGINEERING
Analysis control and new design studies

Dynamics Analysis & Test
Vibration flutter and dynamics loads

Flight Test Instrumentation

Comprehensive background in AERONAUTICAL, MECHANICAL, CIVIL, ELECTRONIC, MATHEMATICS OR PHYSICS SPECIALTIES desirable for Senior and Group Engineer positions. Excellent opportunities also available for Jr. Engineers.

Submit confidential resume giving full details of education and experience. Personal interview will be arranged.

Martin

THE GLENN L. MARTIN CO.
301 Technical Employment
BALTIMORE 3, MD.

Pioneers in Aircraft since 1909

SPECIAL OPPORTUNITIES FOR

SENIOR ENGINEERS

Convair in cool, clean, beautiful San Diego invites you to join an "engineers" engineering department. Interesting, challenging, essential, long-range projects in commercial aircraft, military aircraft, missiles, engineering research and electronics development. Positions open in these specialized fields:

Electrical Design	Servo-mechanisms
Mechanical Design	Aerodynamics
Structural Design	Thermodynamics
Structures	Operation Analysis
Weights	System Analysis

Generous travel allowances to those accepted. For free brochure, write Mr. H. T. Brooks, Engineering Dept. 290

CONVAIR
IN BEAUTIFUL
SAN DIEGO
3302 PACIFIC HIWAY
SAN DIEGO 12, CALIFORNIA

FORMER

EASTERN AIRLINES DOUGLAS DC-3S

AVAILABLE FOR LEASE

We have available for immediate lease to corporations and airlines DC-3 Passenger and Cargo Airplanes. These aircraft are fully equipped for scheduled airline operation. Executive versions also available. Call on us for more information on the advantages of leasing. We can give you all the advantages of ownership without large capital expenditure. Let us show you the advantages of our corporate leasing plan. Our 20 years of aviation knowledge is at your disposal. Airplanes available for inspection at our Fort Wayne or Miami, Fla., base. Available with Wright or P & W engines.

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1104 C of C Bldg.

EXECUTIVE AIR INC.
BAER FIELD - FORT WAYNE INDIANA
PHONE HARRISON 2225

MIAMI
Phone
9-1218

LOCKHEED LODESTAR

Model 18-56, Serial # 2445. Will convert to customer's specifications. Zero time since overhaul $38,000 as is, or $87,500 zero time, fully converted to customer's specifications.

PV-1

400 hrs. TT. $39,500

B-25

Less 100 hrs. TT. New engines and props.—Curtis Wright R2600-29's, Hamilton Hydromatic Prop. Standard Instruments. New license upon sale. Price upon request.

AMERICAN AIRCRAFT CORP.
Dept. A.W. Teterboro Air Terminal
Teterboro, N. J. HAsh'k Hls 8-9279, 1482

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— Fixed & Rotary Wing —
Complete Ships or Components
Stress Analysis & Aerodynamics

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Tel. Milford 2-8338

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Either way our 28 years of experience and nation-wide contacts are at your service in Personal, Executive and Transport Aircraft.

JIM WELSCH
AIRCRAFT SALES
60 East 42nd Street, Suite 628
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Authorized Factory Sales and Service

for

*** Eclipse—Pioneer**
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Contractors to U. S. Air Force

Our stock of instruments is one of the largest in the East.

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IMMEDIATE DELIVERY—WE INSTALL

40', 148', 198' widths, any length

ANDERSON STRUCTURAL STEEL CO.
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ARIZONA 32681 BRADSHAW 21242

EXECUTIVE TRANSPORT AIRCRAFT

DOUGLAS, LOCKHEED, BEECH, GRUMMAN, and CURTISS aircraft for sale. For top value executive aircraft call or write

ATLANTIC AVIATION CORP.
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HA 8-1740

Complete aircraft maintenance facilities at Teterboro, N. J., and Logan Airport, Boston.

HAMILTON STANDARD

Propellers—Governors—Parts

LARGE INVENTORY

Advise Your Requirements

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LAndor 7871

NEED A PLANE FOR

High altitude photography?
High altitude high speed transportation for 3?
Chasing saucers?

This twin engine plane has a pressurized cabin and will be zero time throughout. Performance at 40,000 feet, 400 miles per hours, range 3600 miles. Price—$125,000.

AIRCRAFT SALES LTD.
5478 Wilshire Blvd.
Los Angeles 36, Calif.
Cable "Craftair"

AIRCRAFT ENGINES

(16) Wright 200, 9-CYL., Rated 800 HP at 2300 RPM, brand new, boxed for export. $500 each. (Government cost $8000 each)

COASTAL MACHINERY SALES
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FOR—LEASE OR SALE

C-46A

PASSENGER AND CARGO

EXECUTIVE AIR INC.
1104 C OF C BLDG. MIAMI, FLA.
Phone 9-1218

LOCKHEED PV-1

Speed 260 mph (T.A.S.) - Range 1500 Mi.

We have several Lockheed PV-1 Venturas that are ready for immediate flyaway. They are now unconverted. Aircraft are very low time—one having a total of only 440 hours since new. These ships are in unusually fine condition. Will stand rigid inspection.

These Ships may be inspected at Fort Wayne, Baer Field

Call or Write

LEEWARD AERONAUTICAL
Fort Wayne, Ind. Ph. H-2145

DOUGLAS PARTS

DC3 — DC4

Fuselages - Wings - Nose Sections Ailerons - Flaps - Rudders - Landing Gears - Wheels - Dem. Power Plant Units - Doors and other items as well as all component airframe parts.

Transport Aircraft—Engines—Airline Equipment

IRLINE EQUIPMENT CORP.
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MARKET 2-0963-4

AIRCRAFT HARDWARE ELASTIC STOP NUTS

IMMEDIATE DELIVERY — SEND FOR LIST

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212 W. Bigelow Street
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FOR SALE

15 R1340-AN1 Pratt & Whitney engines, overhauled in CAA approved shop, standard cylinders.

AIRCRAFT SALES LTD.
5478 Wilshire Blvd.
Los Angeles 36, California

WHAT DO YOU NEED?

Buy from one of America's largest stocks of

UNUSED AIRCRAFT PARTS

1500 COMPLETE UNITS OXYGEN BREATHING EQUIPMENT

For high altitude flying—new surplus—complete, ready for use. Manufactured for U. S. Navy. Available for inspection. Priced at a fraction of original cost.

AIRCRAFT ENGINES

WRIGHT

Quantity		Quantity	
1	R1820-52 Low total time since new	4	R1820-60 Low total time since new
16	R1820-54 Low total time since new	4	R1820-62 MTSN

PRATT & WHITNEY

1 R1830-43 LTSO

750 OXYGEN and CO_2 CYLINDERS
Various Sizes—Shatter Proof
High pressure—with valves

1 CARLOAD
Miscellaneous Engine Parts for RANGER V-770

TURRET PARTS
Manufactured by or for General Electric
Control units—grips—motors
Amplidynes, etc.

500 LBS
Nichrome Alloy Wire .0031 enameled Manufactured by Driver-Harris Co.

MISCELLANEOUS COMPONENTS

(Many items in this group have not been listed in previous ads.)

Quantity	Part No.	Mfg.	Description
20	36001-0	Eclipse	Compass
11	14601-1F-B1	Eclipse	Gyro Indicator
71	828TY13Z9	Weston	Oil Temp Indicator
40	119862	Weston	Carb. Air Temp Indicator
10	15401-1	Eclipse	Amplifier (PB10)w/ED3 MOUNT
66	10078-1AG	Eclipse	Gyro Indicator
62	CQ-9	Eclipse	Clutch Switch (PB10)
57	MF45-3911-20Z	Vickers	Hydraulic Pump (3000PSI)
327	PF4-713-20BCE	Vickers	Hydraulic Pump
75	1416-19E	Eclipse	Starter
142	[redacted]	Airesearch	Jack (Cowl FLAP)
45	AN4103-2	Clifford	Brass (Valve #U4785) Oil Cooler
120	MF9-713-15A	Vickers	Hydraulic Pump
550	TFD 8600	Thompson	Fuel Booster Pump
125	D7818	Adel	Anti-icer Pump
950	AN4014	Erie Meter	Wobble (D-3) Pump
1000	AN5780-2	G.E.	Wheel & Flap Position Indicator
400	AN5780-2	Weston	Wheel & Flap Position Indicator
115	P4CA2A	Parker	Primer
70	AN3913-1	Scintilla	Ignition Switch
450	A-9 (94-32226)	Nasco	Ignition Switch
90	JH950-R	Jack & Heinz	Starter Motor
53	AN6903-3	Bendix	Accumulator 10"-1500 P.S.I.
140	K14949E	Marquette	Windshield Wiper Kit
188	EYLC-2334	Barber-Colman	Control
11	12086-1C	Eclipse	Amplifier
250	558-1A	Eclipse	Oil Separator
100	716-3A	Eclipse	Generator (NEA-3A)
89	318	Edwards	Horn
230	921-B	Stewart-Warner	Heater (200000 BTU)
97	6041H-146A	Cutler Hammer	Relay (B-12)
22	0655-D	Aro	Oxygen Regulator
65	ASDC2	CO_2 Mfg. Co.	Fire Detector
384	564-2A	Eclipse	Oil Separator

PRATT AND WHITNEY AIRCRAFT ENGINE PARTS

Quantity	Part No.	Description
166	1045A	Bearing
500	3506	Flange
130	8288	Follower Ass'y
814	35814	Blower Ass'y
53	48362	Shaft
75	48363	Shaft
56	48398	Sump
390	48461	Gear
78	76236	Gear
1178	84289	Bearing
113	84487	Housing
77	84591C	Nose Housing
200	48350-D	Crankcase Ass'y
200	84083	Cylinder
100	84084	Cylinder
200	84085	Cylinder

CARBURETORS! MAGNETOS! SPARK PLUGS!

Quantity	Part No.	Description
247	PD12K10	Strombers injection Carburetor
19	1375F	Holley carburetor
407	SF9LN-2 (manufacturer's part No. 10-12453-6 Spec. AN9511)	Bendix Scintilla Magneto
42	SF5RN-12 (manufacturer's part No. 10-26170-1)	Bendix Scintilla Magneto
185,000	LS4AD1	Spark Plug (Aero)

43 PIECES ENGINE QUICK CHANGE UNITS Applicable to GRUMMAN FM-1 AIRCRAFT. COMPLETE with ACCESSORIES

2000 OIL COOLER ASSEMBLIES W/VALVES
From 5" to 16" diameter
Manufactured by Harrison Radiator Co. and United Aircraft Products

18 PIECES ENGINE QUICK CHANGE UNITS APPLICABLE TO CONSOLIDATED VULTEE B24D

SPECIAL GROUP!

Ideal for tear-down for parts

Quantity	Part No.	Description
1328	PD12K10	Strombers injection carburetor
236	PR48-A1	Strombers carburetor

We own and offer all parts listed—plus many thousands more—stocked in our Baltimore warehouse. Write for **FREE CATALOG** Please make your request on your company letterhead.

COMMERCIAL SURPLUS SALES CO.

4101 CURTIS AVENUE, BALTIMORE 26, MARYLAND — TELEPHONE: CURTIS 3300

COCKPIT VIEWPOINT

By Capt. R. C. Robson

Our Obsolete Pilot Training

The system of checking the flight proficiency of airline pilots every six months has been in effect for many years. During the more leisurely days of aviation, each airline, as required by law, had practice aircraft available so the pilots could renew certain skills from time to time. Today, with hourly operating costs running to hundreds of dollars, the airline trainer has disappeared completely. Yet every six months pilots are expected to demonstrate maneuvers which they have not performed since the previous check.

On the one hand the law says, "Do it or lose your license," while at the same time practical economics say, "No practice allowed." Even to the uninitiated, this must seem a strange procedure.

▶**Much Has Been Added**—The check ride of yesteryear required about two hours to complete. It included a radio orientation on a range station, an instrument approach, single engine pull-out and the usual steep turns, stalls, cross-wind landings, etc. This at the rate of $50-100 per hour.

Like Topsy, today's check has grown. None of the previous has been eliminated and much has been added. We now have an ILS, a GCA, a VOR and an ADF approach to make. We have various combinations of partial-power flight with four-engine planes; there are traffic control procedures, emergency procedures, VOR navigation and many other things. To cover these items, even on a "once-over-lightly" basis, requires a minimum of four hours in the air. At present costs it is easy to see the economic impossibility of this system.

The net result of this needlessly detailed "six-month check" is that the pilot does not have adequate practice on the "neck saver" items—partial-power flight, landings under extremely low visability conditions and emergency operations. There is a saying that modern aircraft do not allow the pilot to make the same mistake once. If this perfection is to be maintained, changes are needed in our training programs.

First, it must be realized that pilots want and need practice on the important maneuvers. And we mean practice with a competent teacher chosen equally by the pilot and the airline and sanctioned by CAA. Receiving instruction from a person of your own choice whose abilities you respect is vastly different from a check ride examination by a person who has simply been designated to see if you are up to snuff.

▶**Name Change**—Next we change names. The "six-month proficiency check" becomes something more like "semi-annual training flight"—making sure, of course, that the spirit of the thing is also changed. Now the pilot can begin to learn since he is free from the false pressure of the "check ride."

For years, scientists have been devising tests in a vain attempt to learn how people will react in emergencies. In aviation the false emergency on a check ride is used for this but the result is just as futile. "Check ride pressure" means only one thing to the professional pilot: that his job and the security of his home and family are being threatened. Few men can take this treatment without considerable strain and the most nervous here may be the calmest during the next genuine emergency.

The third step is to use a modern synthetic trainer where navigational problems, use of equipment, cockpit procedures and many other things can be done. This leaves the flying time free for the important maneuvers.

It is strongly recommended that the psychology of the check ride, as well as the methods and equipment, be changed. Modern flying requires modern thinking for safety.

WHAT'S NEW

New Publications

Aircraft Manufacturing—How to Get and Hold a Good Job is, as its title implies, a vocational guide. This one is aimed at those without any prior aviation experience, and though only 46 pages, lists numerous jobs, what they entail and outlines opportunities. Prepared by Industrial Research, Box 398, Johnstown, Pa., price $2.

Specifications for Copper and Copper-Alloy Welding Rods, covers filler metals for use with oxy-acetylene, carbon arc and inert-gas metal-arc welding. Twelve types of welding materials are covered.

Available from either American Welding Society, 33 W. 39 St., N. Y. 18 or American Society for Testing Materials, 1916 Race St., Phila. 3, Pa. Price 40 cents.

Telling the Market

Illustrated 11 in. x 17 in. sheet displays most popular **AN hydraulic fittings** and can be attached to wall or put under glass desk top for ready reference. Included is a standard letter-size index page describing fittings from AN-3 to AN-3108. Write Linair Aviation Supply, 229 Hindry Ave., Inglewood, Calif.

Heat in Harness is a colorful story of **combustion engineering developments** covering numerous industries, including Janitrol aircraft heating equipment. Available from Surface Combustion Corp., Dept. 1,000, 400 Dublin Ave., Columbus 16, Ohio.

Information on **industrial freezers and complete temperature range testing units,** with illustrations on 12 models built by Webber Appliance Co., Inc., as well as data on 36 standard models can be had by writing the firm's Industrial Freezer division at 2740 Madison Ave., Indianapolis, Ind.

Rubber-to-metal bonding supplement to Catalog 51 issued by Acushnet Process Co. supplies more detailed information on these adhesion problems. Explained are applications, procedures, design, compounding, processes and bond strength ratings. Write the firm at New Bedford 1, Mass.

Publications Received

• **The Social Impact of the Warsaw Convention,** by Harold J. Sherman, published by Exposition Press, Inc., 386 Fourth Ave., New York 16, N. Y., 1952, $3.00. A critique of the Lee decisions on the Warsaw Convention and a plea for early rectification.

ADVERTISERS IN THIS ISSUE

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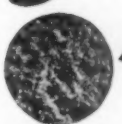

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EDITORIAL

The Complexity Problem-II

(The chief project engineer at the Royal Canadian Air Force's Central Experimental & Proving Establishment at Ottawa has released these personal views to AVIATION WEEK. *They also appear in the current issue of the RCAF publication, The Roundel, under the title, "Is Fighter Design in a Rut?" During the last war, the author flew fighters with the RAF and RCAF in Egypt, Malta, Sicily and Italy. After the war, he received his Master of Science degree at the University of Michigan. His stimulating comments will be concluded on this page next week.—***R.H.W.**)

By Wing Commander A. U. Houle, DFC

There is a strong tendency nowadays to design aircraft and to include additional equipment for the sole purpose of cutting down peacetime losses. This springs from a notion that the public will howl at losses in peacetime but will accept anything in time of war.

The notion is a mistaken one: The public will accept facts. The additional equipment is put there to protect pilots. The performance of the aircraft suffers; and ten, maybe more, conscientious and wide-awake men are lost in combat for every incompetent who is saved during training.

How often do operational requirements personnel and design engineers figure out the cost in an aircraft's performance—and therefore the added risk—as opposed to the possible safety factor that added equipment will give?

Psychologists and doctors point out that roomy cockpits and other comforts cut down on pilot fatigue. Though this is true in pleasure-flying, a fighter pilot on operations could not relax even if he were able to stretch out in an easy chair. He can afford to get very tired and uncomfortable, if gracious living in the cockpit is going to bring bullets 'round his head instead of additions to the number of his kills. Therefore, unless the added equipment will result in an all-'round saving—leave it out.

Once an aircraft is built it is difficult to calculate the effect of an additional 10, or even 100, pounds of weight; and the tendency is to say "put it in." But, as Mr. E. H. Heinemann of Douglas Aircraft Co. has pointed out: "In the design of a current new model, if a 100-lb. item of equipment is added, and the performance and strength are maintained, the gross weight will increase—not 100 lb.—but by a factor of 10, or a total of 1,000 lb.

Thus the weight adds up rapidly and can relegate an otherwise good aircraft to one that is only moderate or even dangerous in the face of the enemy. The following paragraphs outline a few specific instances where it is considered that there is considerable room for improved thinking. They do not pretend to be exhaustive, nor may they in all cases be legitimate criticism; but they are worth investigating.

► **Engine Starters**—Engine starters for jets are contributing far too much to the weight of the aircraft. Even if the cartridge starters now becoming available weigh much less than electrical starters, we must consider the additional weight which is added in making the installation. Airborne starters usually add more than 100 lb. to the aircraft and are only used when the plane is on the ground. Doesn't this seem a bit ridiculous? Surely a little more thought could produce a mechanical or electrical ground starter to be fitted on the compressor end of the shaft. Another possibility is the use of compressed air. Possibly design along these lines is in progress, but the fact remains that our present fighters have been built with the old-time starters.

This can only be attributed to lethargy or to disinterest in the welfare of those who fly our fighters in a possible next war. It is to be hoped that the problem and cost of supplying such starters at all bases is not used as an excuse. Such an excuse would be palpably absurd in view (quite apart from lost aircraft and lives in war) of the cost per ton-mile of carting extra weight through the air, the cost of present ground and air starters, and the added cost of the structural materials which must be built into the aircraft components to maintain strength and performance.

► **Radio Navigation Aids**—Useful though they are in peacetime to aid us in flying from point to point, our next enemy may not play ball and provide radio beacons over his territory in time of war. He may, indeed, not even allow us to use our own. There is a strong possibility that fighters in front-line areas will be completely directed by ground radar. Possibly the weight of a radio compass in a fighter is justified, but its use in training should be restricted (by a seal which may be broken if necessary) in order to accustom pilots to navigating without its help. Other navigational aids must receive even more critical consideration.

► **Automatic Temperature Control**—This cockpit feature and the inclusion of temperature gauges on an already full instrument panel, indicate how easy it is to lapse into a somnolent state as far as unnecessary equipment is concerned. Though not much may be added in terms of weight, life is made more complicated both for the pilot and the servicing crews. Is automatic temperature control necessary at all? Does the Air Force select pilots who don't know when they are hot or cold or who are unable to open a simple manual valve? Does a pilot care what the exact temperature is so long as he is neither too hot nor too cold? The optimum temperature will vary according to the amount of flying clothing the pilot wears, his physical condition, and the amount of exertion he puts forth, so that he will have to adjust the thermostat anyway. Let us minimize the gadgetry and weight.

► **Emergency Units**—More and more emergency or dual units are being added. Rigid equipment specifications control the weight of units to a point at which their reliability is impaired and a second one must be installed as a safety factor against emergencies. One specific case is the emergency fuel pump and regulator installed in some jet aircraft. It would be interesting to get statistics on the number of times it has actually been required as compared with the accidents caused by inadvertently leaving it on—especially when an overshoot makes it necessary to "go 'round again." All it really accomplishes—let's face it—is the addition of weight and needless complication.

► **Armament**—Have we forced armament design to keep pace with aircraft performance, or does the weight of guns just keep on going up as the square of the bore? Are we not making a fetish of gun life and reloading time, as evidenced by gun packages, and forgetting all about weight? Pare the size and weight down, even if guns only last for 1,000 rounds, and the aircraft that are saved could be standing by already refueled and rearmed for the next sortie. It is easier to put in new guns than to provide a new aircraft. Statistics on the average life of a fighter aircraft in front-line operations during the second World War might give a target at which to aim. The heaviest and best guns in the world are no good unless the mother aircraft has performance to match the enemy's.

(To be concluded next week)

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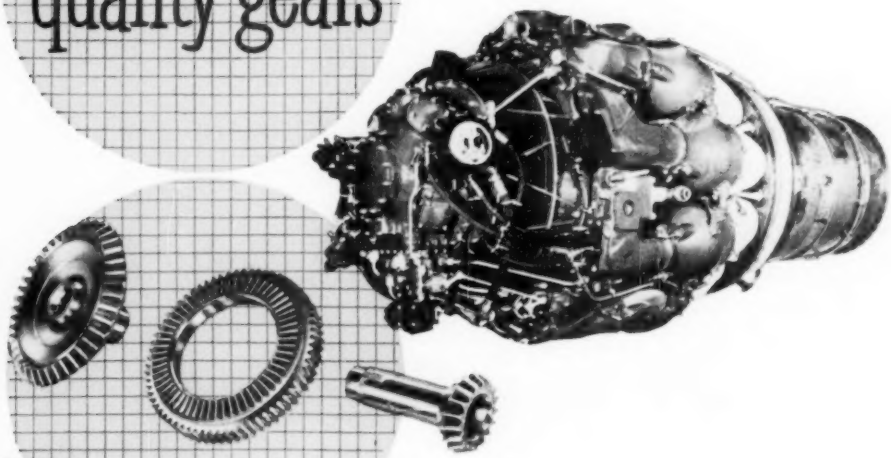

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